ELECTRICAL REVIEW

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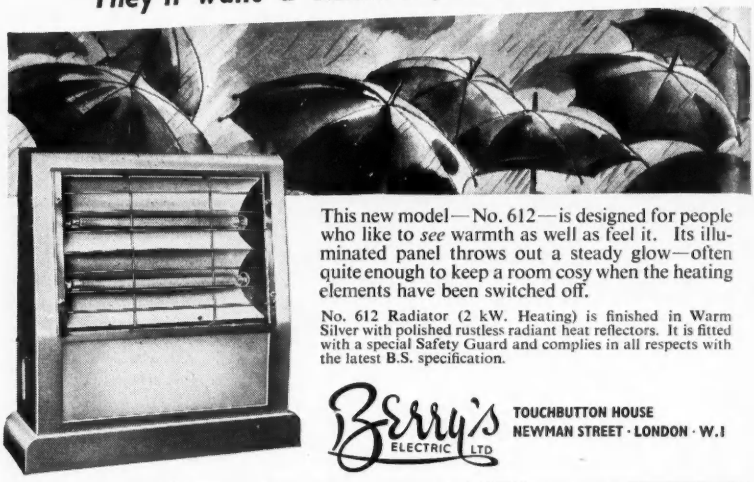

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ELECTRICAL REVIEW 12th DECEMBER, 1952

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. CLI • NO. 3916

Decentralization

ALL parties were agreed, years ago, that co-ordination of the electricity supply industry was necessary, two principal reasons being the lack of uniformity in supply systems and tariffs (which led to unwarrantable differences in conditions in different areas) and the necessity for filling in the rural gaps. It is true that only one party equated co-ordination with nationalization but that party had its way. Possibly, judging by what went before, this was the only means of securing some sort of integration.

However that may be, once the industry was nationalized the Central Authority and the Electricity Boards had to assume full responsibility for the service and this meant concentrating all aspects of the business as rapidly as possible, so that the units within the industry would not operate at cross-purposes. It is only too well known that any advantages brought about by centralization may be seriously offset or outweighed by the disadvantages—the unwillingness of subordinate officials to take decisions; the actual discouragement of initiative and responsibility; the tendency to work to rigid rules; excessive economy in some directions and too-lavish expenditure in others.

Under the old dispensation the chief engineer or manager (often the same person) ran his undertaking with full knowledge of its different departments and a free hand in the spending of money. Any tendency of the manager to over-spend was checked by the knowledge that he was responsible to his committee or board for the financial success of the undertaking. Now accounts cover wider areas and the district managers (roughly the equivalents of the former engineers and managers) are not responsible for the finances of their districts. Some districts no doubt run at a loss (especially in the rural areas) while the others make this up: that was one reason for co-ordination.

District managers do not do their own buying, and while they may express their views on equipment and appliances they do not

have the final decision or the purchasing of them. This rests with the Area Board or perhaps the Sub-Area administration, for the question of stocks of spares has to be considered.

There are constant demands for "decentralization" but can this be achieved without again splitting up the system into loosely bound local formations? And would this not represent a restoration, under different ownership, of conditions already recognized as undesirable? So far the decentralization proposals which we have seen have not really answered these questions. Is there a practicable solution?

UNDERGROUND OR OVERHEAD?

A nice point is raised in the 1951–52 report of the National Parks Commission (reviewed in this issue). It is the Commission's aim to secure the burying of electric lines where to run them above ground would injure amenities but the Commission realizes that this involves extra cost when the electricity authorities' expenditure is being rigidly restricted. In fact, the authorities may have to deny other districts electricity if they are forced to spend too much of their resources on underground distribution. The Commission still thinks that special cases involving relatively short lengths of underground cable should receive special attention.

RAILWAY ELECTRIFICATION

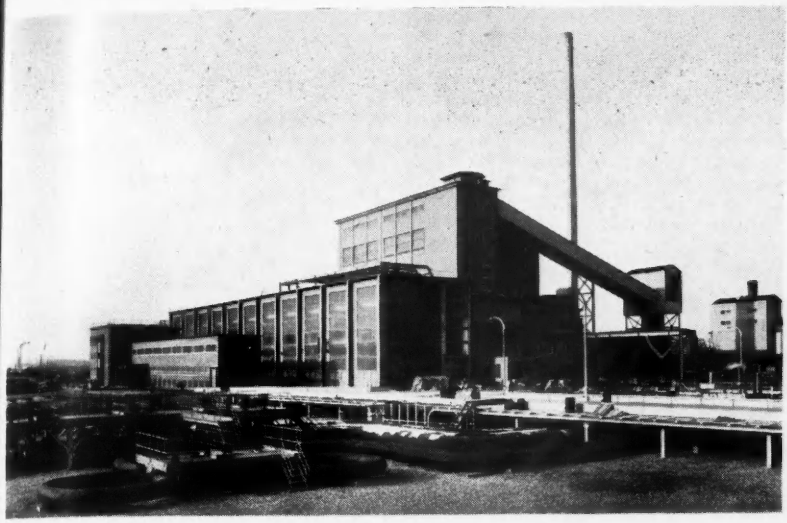
Having regard to the high proportion of the capital cost of railway electrification incurred in providing the overhead equipment, any economies that can be made without sacrificing reliability are well worth while. In their I.E.E. paper, reported in this issue, Messrs. O. J. Crompton and G. A. Wallace make it clear that considerable total savings can be made through departures from former practice in relatively minor items. Further economies would no doubt be obtained if, as the authors suggest, plans were made to proceed with electrification for a minimum period of ten years at a rate of not less than 100 single-track miles each year, i.e., the economical duty of one field unit operating from one stores base.

THE "FOURTH LEG"

A correspondent in this issue points out that when we suggested on 28th November that practically everybody in the electricity supply industry had now secured salary or wages increases we forgot the "fourth leg"—the managerial grades. These unfortunates have remained suspended between the chief executives and their deputies above and the technical grades more or less below. A Joint Committee for these people and the B.E.A. and Area Boards was formed last year. The B.E.A.'s last report (paragraph 299) described the "machinery" as simple in character. Settlement of scales of salaries is apparently proving not so simple for all the report could say was that at the end of the year salary scales and a salary claim were "under consideration." We can appreciate the impatience of those concerned.

COMMODITY PRICES

One of the subjects discussed at the Commonwealth Economic Conference last week was commodity prices. The violent movements in these prices in the last two years, mainly as a result of the Korean war, have had serious effects upon the trade balances of some of the countries in the sterling area. Manufacturers would also welcome greater stability in commodity prices. Frequent fluctuations make estimating for contracts very difficult, even if adjustment clauses are adopted. The erratic course of prices is illustrated by the case of rubber which before the Korean troubles stood at $24\frac{3}{8}$d/lb, rose to a peak of $69\frac{1}{3}$d and now stands at about 27d. Copper shot up and has remained at a level of about 50 per cent above the previous figure. Lead also rose steeply but has reverted to something like its "pre-Korea" price.



Wilton Power Station

Process Steam and Electricity Generation

INTERLINKAGE of nine plants making chemicals from petroleum distillate oil, so that the product of one becomes the raw material of another, is a major feature of the Wilton works started towards the end of 1946 by Imperial Chemical Industries, Ltd. One-tenth of a site of 2,000 acres between Middlesbrough and Redcar (Yorkshire) will be occupied by the end of next year. In addition, an area of 400 acres on the River Tees, two miles away, is connected to the main site by a 500ft wide land corridor and to the Billingham works of the company on the Durham bank by pipelines in a 9ft diameter tunnel, 1,750ft long, 100ft below the river.

The power station has been designed primarily for the provision of steam at 250 lb/sq in for evaporating organic liquids and at 20 lb/sq in for space heating and water evaporation. The adoption of higher steam pressures enabled electricity to be generated economically as a by-product. In the first section of the power station steam is raised in two 265,000 lb/hr Babcock & Wilcox high-head boilers; a third is being installed. Superheater stop-valve steam conditions are 950 lb/sq in and 950 deg F, with a feed-water temperature at the economizer outlet of 498 deg F, the inlet being at 388 deg F (1,125 lb/sq in).

Each boiler has a heating surface of 4,620 sq ft and a furnace (Bailey Wall) heating surface of 3,290 sq ft. The combustion chamber is 18,500 cu ft in volume and the heat release rate 21,500 B.Th.U./cu ft/hr. Tubular attemperators (2in) are used, the cooling medium being taken from the furnace side walls.

Firing is by pulverized coal, waste gas or, in emergency, oil, either alone or in combination. Three 13,500 lb/hr mills are installed per boiler to pulverize 70 per cent through 200 B.S. and 99 per cent through 52 B.S. mesh sieves. The Howden system of induced-draught, forced-draught and primary-air fans is used. Dust is extracted from the flue gases by 16 Buell 4ft cyclones followed by a Sturtevant electrostatic precipitator for each boiler. Ash

is handled by B. & W. hydrojet plant and pumped to lagoons. Coal is fed by side discharge wagon tippler with Avery weigher on to belt conveyors regulated by a Locker Traylor vibratory feeder, with final feed to 660 ton bunkers by shuttle band conveyor.

About half of the condensed steam is returned to the power station, make-up being obtained from the town supply after demineralization by a Permutit plant of 23,000 gal/hr capacity, using three de-acid and three hydrogen-ion units. It is then fed to a degassing tower to remove CO_2, heated, and passed to Hick Hargreaves de-aerators, three of which, each of 600,000 lb/hr, are installed. Further treatment consists of continuous dosing with caustic soda, sodium sulphate and sodium sulphite and reheating before being pumped into the boiler drum, where it is intermittently dosed with di-sodium phosphate and tannin. Two 132,000 lb/hr oil-fired boilers generating steam at 250 lb/sq in and 640 deg F originally installed for supply of steam on the site are now used as stand-by.

Back-Pressure Turbines

Electricity is generated by four Metropolitan-Vickers 3,000 r.p.m. turbo-alternators. Two of the turbines are back-pressure units supplied with 540,000 and 270,000 lb/hr of steam at 900 lb/sq in and 900 deg F; part of their exhaust at 253 lb/sq in is used for process, but the bulk goes to two secondary turbines, taking up to 200,000 and 420,000 lb/hr, from which most of the steam is passed out at 20 lb/sq in, leaving one-quarter of the initial total amount to be exhausted to condensers at a vacuum of 28·5in Hg.

There are three pairs of Mather & Platt circulating water pumps with individual duties of 4,500, 9,200 and 2,400 gal/min. These are associated with a sixteen-cell induced-draught cooling tower made by Film Cooling Towers, of 924,000 gal/hr. The associated feed-heating system is in seven stages, viz:—blow down, glands (two stages), low-pressure steam, de-aerator, intermediate bled steam and final intermediate-pressure steam. The larger pass-out set deals with 600,000 lb/hr and the smaller with about half that quantity.

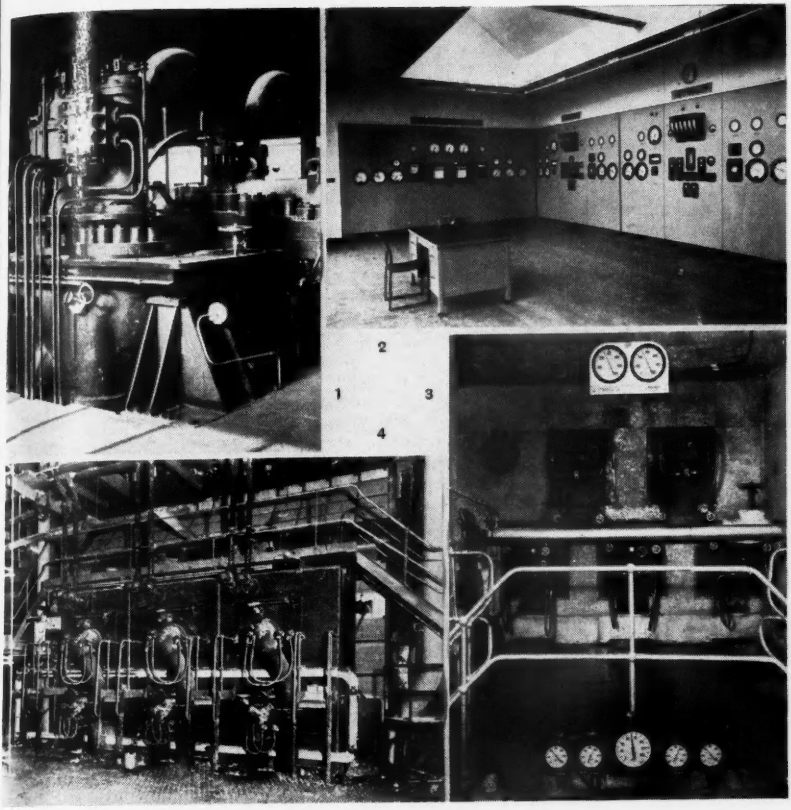
In the turbine house are also the following pumps by Mather & Platt, each with the delivery duties stated: three electric and one steam lift, 300,000 lb/hr, 242 deg F and 375 lb/sq in; three electric and one steam feed pumps, 300,000 lb/hr, 392 deg F and 1,205 lb/sq in. Three 270,000 lb/hr primary desuperheaters and reducers, 900 lb/sq in and 900 deg F to 253 lb/sq in and 640 deg F, and two 65,000 and 130,000 lb/hr intermediate-pressure desuperheaters to control export steam to 640 deg F have also been installed.

Electrical Equipment

Two three-phase 50 c/s 11·5 kV alternators coupled to the back pressure turbines have maximum continuous ratings of 17·5 and 8·3 MW and the two others 23·5 and 11·35 MW, all at 0·8 power factor. These machines run in parallel with the North Eastern Electricity Board via two 66 kV 30 MW feeders and four 15 MVA 66/11·5 kV transformers with on-load tap-changing gear by C. A. Parsons & Co., Ltd. The main switchgear, by Reyrolles, is of the 750 MVA double busbar type in two sections separated by a busbar reactor. To each section are connected two alternators and one Board's feeder and feeders to the works plant. Space is provided for two further sections of up to 40 MW each. The station earth comprises twelve 12ft and four 8ft copper rods, to which the alternator neutrals can be connected by Reyrolle Type C switchgear via a Met-Vick 1,500 A liquid resistor.

Station auxiliaries are supplied through two 5 MVA 11·5/3·3 kV Parsons transformers, one from each busbar section, controlled by English Electric 3·3 kV 150 MVA air-break double busbar switchgear. Power at 415 V and lighting are obtained from two 500 kVA and three 1,000 kVA Lindley Thompson transformers associated with 415 V Met-Vick air-break switches and distribution fuse-boards by Parmiter, Hope & Sugden. Mather & Platt squirrel-cage induction motors are used throughout, the larger types (generally 200 h.p. and above) being wound for 3·3 kV and connected to English Electric direct-on circuit breakers. The remainder have 415 V direct-on contactor starters by Brookhirst and Allen West or oil-break starters by Ellison.

A 45 kV d.c. supply for the Sturtevant precipitators is provided by a mechanical rectifier, a 50 kVA step-up transformer, a regulating transformer and control equipment by the B.T.H. Co. Two Chloride batteries controlled by Whipp & Bourne switchboards are installed. One of



1. Steam chest of high pressure end of 17·5 MW primary turbine of 60 MW construction. 2. Control room from which steam flow at 250 lb/sq in is regulated. 3. Front of 250 lb/sq in oil-fired boiler. 4. Firing front of high pressure boilers showing pulverized coal feed with oil firing connections and, above these, control valves for waste gas supply

600 Ah, giving 110 V supplies for switchgear operation, governor and valve-operating motors and emergency lighting, is associated with a Cycloc charger and Hewittic mercury-arc rectifier, the latter for quick charging. The second, with another Cycloc charger, provides a 50 V supply for alarms and telephones.

Most of the lighting is fluorescent with fittings by Atlas, Benjamin and the G.E.C., and alternate fittings are usually fed from a different one of two supplies. Mixed mercury and tungsten lamps are used at the coal-handling plant. Paper-insulated lead-covered steel-wire-armoured cables are employed for all high-voltage and the larger medium voltage cables; the remainder of the wiring is part Pyrotenax and part polyvinyl chloride steel wire armoured.

Northumberland Plan

A 20-year development plan for Northumberland drawn up by the County Council states that it is proposed to erect a new electric power station at Cambois, Blyth, and high voltage lines from the new Newburn-on-Tyne power station along the Tyne Valley as far as Greenhead and also to Blyth.

New Books

Examples in Electrical Calculations. Naval Electrical Department, Admiralty. Pp. 507; figs. 240; answers. H.M. Stationery Office, York House, Kingsway, London, W.C.2. Price 17s.

The working out of numerical examples is an important, if not vital part of all engineering examinations. This is particularly so in electrical engineering where in certain sections such as a.c. theory considerable mathematical knowledge is required. This book was originally compiled with a view to providing Naval students of electrical technology with a collection of worked examples and carefully graded sets of exercises ranging from Ohm's law to d.c. and a.c. machines and polyphase transmission systems. These may also be said to cover the requirements of students preparing for examinations up to and including the Ordinary National Certificate in Electrical Engineering.

The work is divided into 29 chapters each covering a specific part of the syllabus and comprising a brief survey of the principles involved together with the required formulæ. A few typical examples are then worked out in detail and these are followed by a carefully graded set of exercises with numerical answers. The first part of each chapter is illustrated by clear diagrams, two or three colours being employed in some of the graphs and vector diagrams. A number of appendices are included covering the usual mathematical tables and a summary of the more fundamental formulæ in C.G.S. units and both the rationalized and unrationalized M.K.S. units.

In making this book generally available, the Admiralty deserves the gratitude not only of all electrical engineering students but also of their lecturers.—A.R.

Electrical Construction Testing and Repair. Edited by E. Molloy. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Pp. 164; figs. 125; index. Price 17s 6d.

The eight writers of this book deal with a rather miscellaneous assortment of plant, such as electric motors, X-ray equipment, domestic electrical apparatus, accumulators of the lead-acid and steel-alkaline type, etc., rather more than half the work being devoted to motors of various types. Thus the book will be of value to plant and maintenance engineers and electricians.

The first and largest chapter is a most useful contribution on the subject of the care, maintenance and repair of electrical (rotating) machinery. The emphasis is rightly placed on maintenance and avoidance of breakdowns. In some motors the only parts which are subject to normal wear are the bearings, so the writer is justified in using about 24 pages on bearings. It is, however, rather an over-simplification to state, as the writer does on page 5, that if the insulation resistance is below a certain figure the motor requires drying out. There are, of course, many causes of low insulation resistance and testing of individual parts of a motor circuit, as well as inspection of the insulation, may be necessary in order to locate the cause.

The 32 pages on methods of winding fractional horse power motors are principally concerned with copy windings; more emphasis might have been placed on the need for taking accurate details of the original windings and connections; often the failure to do this leads to a motor being scrapped after rewinding. The very practical sections on workshop methods of fault finding and repair deal briefly with the important subject of motor control gear as well as with motors, coils, cables and other accessories; a useful complement to the chapter on testing electrical domestic equipment. The chapter on the repair and maintenance of X-ray equipment gives quite a lot of useful information, while the short chapters on accumulators are concerned with maintenance and charging, but not repair, of the two types of secondary batteries.—J.L.W.

Books Received

Electric Wiring Diagrams. By W. Perren Maycock. Fourth edition revised by A. Serner. Pp. 156; figs. 257. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 8s 6d.

Commercial A.C. Measurements. By G. W. Stubbings. Second edition. Pp. 377; figs. 184; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 30s.

Methods of Electrical Measurement. By C. T. Baldwin. Pp. 182; figs. and index. Blackie & Son, Ltd., 17, Stanhope Street, Glasgow, C.4. Price 17s 6d.

The Condenser Paradox

Some Further Observations

By J. C. MOORE, B.Sc.(Eng.) Hons., A.M.I.E.E.

HAVING been virtually "out of circulation" for a while, I have only just seen the article[1] on the above subject by J. Webb, and am astounded at the number of incorrect ideas contained in it.

First let me say that the particular approach of Mr. Webb is very similar to that of an earlier article[2] elsewhere wherein a solution to the problem is given by Mr. O. P. D. Cutteridge, assuming resistance only to be present in the condenser interconnecting leads. Unlike your contributor, however, who from the tone of many of his statements seems flatly to reject any possibility of oscillatory currents, Mr. Cutteridge does admit that oscillatory currents may occur "although to his mind such a condition may be unnecessary." Your contributor, for instance, states in the fourth column of his article about half-way down "This idea is incorrect because the current $i = I_0\epsilon^{-t/\lambda}$ is unidirectional. . . ." To my mind the danger of your contributor's article is that his inference that oscillatory conditions do not occur is rather dogmatic and to present such an argument as a final conclusion in the accepted authoritative pages of the *Electrical Review* is a bad thing.

Incidentally Mr. Cutteridge makes the same play upon the observation that the interconnecting resistance R does not finally appear in the actual energy loss expression, pointing out as does your contributor that to decrease R would result in higher surge currents, but the latter would all have correspondingly reduced time constants (for a resistive-capacitive circuit).

Might I point out that the loss of energy may be accounted for in any way whatsoever, the actual choice being governed by what one assumes as the electrical parameters of the interconnecting path between the condensers. Let no one therefore fall into the trap that your contributor (and by implication for having printed the article, yourself also) falls into and that is to assume a particular kind of path, to then integrate the energy losses in such a path, and then upon finding that such energy losses equal exactly those lost by the condenser arrangement as a whole, infer that this proves that the assumed idea of the particular path is the correct one existing practically. It can easily be proved that if any assumption whatsoever as to the electrical constants of the path between the condensers be made, then, providing that one begins and ends with the charges on the condensers as postulated, the energy loss in the assumed path must be equal to that lost by the condenser arrangement as a whole; which is proved easily as follows (assume $v_1 > v_2$):—

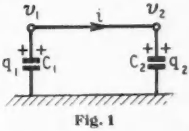


Fig. 1

Consider two condensers, one with charge q_1, voltage v_1 and capacitance C_1, the other with charge q_2, voltage v_2 and capacitance C_2 as shown in Fig. 1.

Of course the significance of the statement that the two condensers possess voltage v_1 and v_2 is that the voltage $(v_1 - v_2)$ is a measure of the work required to pass unit charge between the condensers. If current i flows between the two condensers then the power being expended *in the interconnecting path* is:

$(v_1 - v_2)$ i watts

and in a time dt the joules expended equals:

$(v_1 - v_2)$ i dt joules.

But as $i = \dfrac{-dq_1}{dt}$

$$(v_1 - v_2)\, i\, dt = (v_1 - v_2)\left(\frac{-dq_1}{dt}\right) dt$$
$$= -(v_1 - v_2)\, dq_1 \text{ joules.}$$

[1] "The Condenser Paradox," by J. Webb, *Electrical Review*, 19th September, 1952, p. 625.

[2] *I.E.E. Students Quarterly Journal*, Vol. 22, No. 86, p. 82, December, 1951.

But $\frac{q_1}{C_1} = v_1$, $\frac{q_2}{C_2} = v_2$ and $q_1 + q_2 = Q$ (where Q = the initial charge on C_1).

Hence $-(v_1 - v_2)\,dq_1 =$

$$\left\{\frac{Q}{C_2} - \left(\frac{1}{C_1} + \frac{1}{C_2}\right) q_1\right\} dq_1$$

The initial charge on C_1 is Q and, as is easily proved, after the charge has distributed the final charge on C_1 is $\frac{QC_1}{C_1 + C_2}$. Hence the total energy lost in the interconnecting path during re-distribution of the charge is:

$$\int_{Q}^{\frac{QC_1}{C_1+C_2}} \left\{\frac{Q}{C_2} - \left(\frac{1}{C_1} + \frac{1}{C_2}\right) q_1\right\} dq_1$$

$$= \left[\frac{Qq_1}{C_2} - \left(\frac{1}{C_1} + \frac{1}{C_2}\right)\frac{q_1^2}{2}\right]_{Q}^{\frac{QC_1}{C_1+C_2}}$$

$$= \frac{Q^2C_2}{2C_1(C_1+C_2)} \text{ joules.}$$

As $Q = C_1V_1$ (where V_1 is the initial voltage on C_1) a slight manipulation of the last formula above gives:

Energy loss $= \frac{1}{2}C_1V_1^2 \cdot \frac{C_2}{C_1 + C_2}$ as given in the article by Mr. Webb.

Let it not be suspected in reading the above that I have fallen into the same confusion as Mr. Webb. Although the above expressions seem deceptively simple they do in fact encompass the possibility of v_1 and v_2 being oscillatory or non-oscillatory in nature; that is, the final expression for energy loss in the interconnecting path is quite general. Also its power includes the possibility of any kind of path existing between the condensers; purely resistive, purely inductive, radiative, giving rise to oscillatory currents, not giving rise to oscillatory currents, etc.

It is lack of appreciation of the fact that the losses must occur and do occur in the interconnecting path that gives rise to the condenser "paradox." More or less at the back of my mind while producing the argument above was the idea that free space constituted the path between the condenser terminals and hence the joules of energy expended represents mechanical work done by the forces necessary to transfer the charges. If a resistive path be assumed (as Mr. Webb does) one can show, and Mr. Webb does proceed to show, that the energy losses are bound up exclusively in the production of heat in the interconnecting resistor—again with his simple belief that only unidirectional currents need be considered!

Is this necessarily so amazing? The position is that (*a*) we are free to specify almost at random the kind of path existing between the condensers in order that the charge be transferred and (*b*) being then always in the comfortable position of being able to prove quite neatly that all the energy loss in the condenser arrangement is exactly accounted for by the energy losses occurring in the same convenient path of our own choosing. It is here that one must not be naïvely deluded into offering such equality as a "proof" that the particular path we have assumed is the one occurring in practice. For any particular occasion, only an exact knowledge of all the electrical parameters of bits of connecting wire, leakage, inductance, resistance, etc., can enable us to say where the energy was distributed to on that occasion.

In order here to prove my point about the free choice of path, let us assume the conditions shown in Fig. 2.

Let the initial charge on condenser C_1 be Q (coulombs) and the initial charge on condenser C_2 be zero (coulombs).

As always $q_1 + q_2 = Q$ (i.e., $q_2 = Q - q_1$)

and $i = -\frac{dq_1}{dt}$ such that $\frac{di}{dt} = -\frac{d_2q_1}{dt_2}$

Then $v_1 = v_2 + L\frac{di}{dt} + Ri$

i.e. $\frac{q_1}{C_1} = \frac{q_2}{C_2} + L\frac{di}{dt} + Ri$

$\therefore \frac{q_1}{C_1} = \frac{Q}{C_2} - \frac{q_1}{C_2} + L\frac{di}{dt} + Ri$

Hence $L\frac{d^2q_1}{dt^2} + R\frac{dq_1}{dt} + \left(\frac{1}{C_1} + \frac{1}{C_2}\right)q_1 - \frac{Q}{C_2} = 0$

Let $\left(\frac{1}{C_1} + \frac{1}{C_2}\right) =$ a and for convenience

let $\left(aq_1 - \frac{Q}{C_2}\right) = aQ'$

Then $L\frac{d^2Q'}{dt^2} + R\frac{dQ'}{dt} + aQ' = 0$

This is obviously a standard second order differential equation of first degree with constant coefficients and (without hinting darkly that it can only be solved by means of Laplace transforms, which after all are

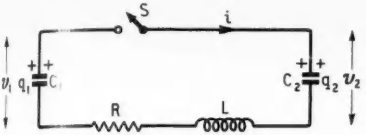


Fig. 2

merely akin to an engineer's ready reference handbook for the easy solution of transient circuit problems involving differential equations) the usual trial solution of $Q' = A\epsilon^{mt}$ can be offered.

Hence $A\epsilon^{mt}\left\{Lm^2 + Rm + a\right\} = 0$ such that if $A\epsilon^{mt} \neq 0$,

then $Lm^2 + Rm + a = 0$ from which

$$m = \frac{-R \pm \sqrt{R^2 - 4La}}{2L}$$

Now if $4La > R^2$ (I am here freely exercising my choice to make the solution oscillatory in nature) then:

$$Q' = A\epsilon^{\frac{-Rt}{2L}}\left\{\text{Cos } kt + B \text{ sin } kt\right\}$$

where $k = \dfrac{\sqrt{4La - R^2}}{2L}$

From which

$$q_1 = A\epsilon^{\frac{-Rt}{2L}}\left\{\cos kt + B \sin kt\right\} + \frac{QC_1}{C_1 + C_2}$$

and $$i = -\frac{dq_1}{dt} = A\epsilon^{\frac{-Rt}{2L}}\left\{\left(\frac{R}{2L} - Bk\right)\cos kt + \left(k + \frac{RB}{2L}\right)\sin kt\right\}$$

But as $q_1 = 0$ and $i = 0$ when $t = 0$; therefore the oscillatory current i equals:

$$i = \frac{Q}{C_1 Lk}\epsilon^{\frac{-Rt}{2L}} \sin kt$$

Hence for pure resistance and pure inductance in the interconnecting path between the condensers the total energy loss equals:

$$\int_{t=0}^{t=\infty} R\, i^2\, dt$$

(Note: Regardless of frequency no radiation whatsoever can occur from a pure resistance. Also no radiation losses whatsoever can occur from a pure inductance because even though all its energy is associated with a radiated magnetic field extending to infinity all this energy is subsequently returned upon collapse of the field.)

Hence energy loss in the resistor:

$$= R\int_0^\infty \left(\frac{Q}{C_1 Lk}\right)^2 \left(\epsilon^{\frac{-Rt}{2L}}\right)^2 (\sin kt)^2\, dt$$

$$= \frac{RQ^2}{C_1^2 L^2 k^2}\int_0^\infty \epsilon^{\frac{-Rt}{L}} \sin^2 kt\, dt$$

If the above integral containing $\sin^2 kt$ is split up into the difference of two cosines, and the resulting integral integrated by parts, it can easily be shown that:

$$\int_0^\infty \epsilon^{\frac{-Rt}{L}} \sin^2 kt\, dt = \frac{2k^2L^3}{R(R^2 + 4k^2L^2)}$$

where, as before, $k = \dfrac{\sqrt{4La - R^2}}{2L}$

Hence $$\frac{RQ^2}{C_1^2 L^2 k^2}\int_0^\infty \epsilon^{\frac{-Rt}{L}} \sin^2 kt \cdot dt$$

$$= \frac{RQ^2}{C_1^2 L^2 k^2}\left\{\frac{2k^2L^3}{R(R^2 + 4k^2L^2)}\right\}$$

$$= \frac{2Q^2L}{C_1^2(R^2 + 4k^2L^2)}$$

But as $k = \dfrac{\sqrt{4La - R^2}}{2L}$, $R^2 + 4k^2L^2 = 4La$

where $a = \dfrac{1}{C_1} + \dfrac{1}{C_2}$

$$\therefore \text{ Resistive loss} = \frac{2Q^2L}{(C_1^2)(4La)} = \frac{2Q^2}{4aC_1^2}$$

$$= \frac{2Q^2C_1C_2}{4C_1^2(C_1 + C_2)}$$

But Q initially $= C_1V_1$

$$\therefore \text{ Resistive loss} = \frac{C_1^2V_1^2C_1C_2}{2C_1^2(C_1 + C_2)}$$

$$= \tfrac{1}{2}C_1V_1^2\left\{\frac{C^2}{C_1 + C_2}\right\}$$

which is the same as the expression obtained by Mr. Webb while flatly rejecting the possibility of oscillatory conditions. Notice, again, that the above expression for energy loss, as earlier I stated it must be, is quite independent of any factors whatsoever in the condenser interconnecting leads causing the energy loss.

One further fundamental point in which I cannot agree with your contributor is the point wherein he states that as the resistance of the interconnecting leads is decreased and the initial discharge current reaches high values, the Fourier analysis of the current waveform yields such high frequency components resulting " in almost 100 per cent radiation loss " (this implied to be in a pure resistor). Surely any sudden current change, regardless of magnitude, can produce analytical high frequency current components. (Consider, say, the Fourier analysis of a square waveform or a saw-tooth waveform, both of quite small maximum values.) The point about high frequencies producing radiation is that normally it is only at such high frequencies that the inductive and capacitive effects of a circuit become so prominent as to very definitely aid transmission of electrical energy by radiation. Nevertheless, the highest of frequencies in a pure resistance cannot produce radiation and, to reiterate an earlier point, a pure inductance cannot give rise to radiation loss as subsequently all its magnetic energy is returned to the energizing circuit.

Let not my insistence on this point be misconstrued as meaning that I discount the idea that some of the energy lost by the condensers is radiation loss (or that my previous arguments respecting oscillatory conditions be taken to imply that I do not consider unidirectional current interchange to be likely). Not at all. If one assumes electrostatic and magnetic couplings to remote circuits (as in practice must occur) such is highly probable. But all the coupled circuits, however complex, can be reduced to a simple series arrangement between the condenser terminals consisting of pure resistance, pure inductance and pure capacitance and of these only pure resistance can result in energy loss.

Because of the points just outlined the last paragraph or so of your contributor's article concerning infinite currents yielding pure radiation are fallacious. As far as the idea of energy lost in the spark occurring on connection of the condensers goes, it is quite legitimate, as normally bringing two points of different potentials so close would result in breakdown and ionization in the intervening gap with a resultant resistive loss.

Mr. Moore is Senior Lecturer, Power Group, P.O. Engineering Department, Central Training School.

TRANSPORTING BAUXITE

Ship's Materials Handling Equipment

A NEW type of ore-carrying ship, the s.s. *Carl Schmedeman*, has been equipped to unload bauxite using its own materials handling plant. The vessel, built by Vickers-Armstrongs, Ltd., for Reynolds Jamaica Mines, Ltd., is designed to handle ore with a maximum screen size of ⅜in weighing some 66 lb/cu ft at up to 1,400 tons/hr. The conveying equipment has been manufactured and installed by the Fraser and Chalmers Engineering Works of the General Electric Co., Ltd.

In the holds there are 152 hand-operated hopper gates, enabling the ore to be discharged on two hold conveyors of Robins design, each 397ft long and 42in wide. The drive to each conveyor is through speed-reduction gearing flexibly coupled to a 100 h.p. 440 V, three-phase 60 c/s motor.

Each hold conveyor discharges to a reversible shuttle conveyor mounted athwartships and discharging from either side of the vessel at will. It is 37ft 6in long at rest and extends, by pneumatic operation, 11ft 3in through the ship's side. Motive power is provided by a 20 h.p. three-phase 440 V 60 c/s squirrel-cage, reversible motor.

Electrical control gear supplied by the G.E.C. includes starters for the two 100 h.p. motors, control equipment for the reversible 20 h.p. shuttle conveyor motor, and two 10in Witton-Kramer solenoid brakes for use with the hold conveyor motors. In addition to the shipboard equipment, Fraser and Chalmers Engineering Works supplied the whole of the idlers, pulley outfits and bunker discharging gates for the shore-to-ship loading plant.

All offices, dining-rooms and living-rooms are fitted with 12in oscillating fans made by Woods of Colchester, Ltd., the switches being housed in the bases of the fans. The galley equipment installed in the *Carl Schmedeman* is the first to be supplied by the G.E.C. for a 440 V, 60 c/s supply. The company also supplied the two 25 h.p. steering gear motors.

Preserving Amenities

National Parks and Fine Art Commissions' Reports

ELECTRICITY supply matters again receive attention in the annual report of the National Parks Commission for 1951–52 (H.M. Stationery Office, 2s 6d). North Wales hydro-electric development takes first place, an account being given of the activities of the British Electricity Authority in this direction. The Bill promoted by the B.E.A. which received a second reading on 1st April this year included none of the four major schemes opposed by the Commission. At the instance of the latter several important safeguards (set out in an appendix) were included in the Bill and just before the committee stage the B.E.A. withdrew the Ffestiniog scheme leaving only the extensions at Dolgarrog and Maentwrog. The Bill has now been approved by Parliament.

Effect of Capital Restrictions

In its last report the Commission expressed the view that the extra cost of placing electricity mains underground should be borne nationally and not imposed on local consumers. The B.E.A. and Area Boards could not commit themselves upon the future apportionment of cost. But the immediate problem is the restriction of capital expenditure which deprives some other consumers of a supply if expenditure on a particular scheme is increased by placing lines underground. It is realized that this inevitably limits the extent to which the Commission can press for underground lines but it is considered that the restrictions should not rule out relatively short lengths of underground line where there is a strong case on amenity grounds.

In an appendix particulars are given of several cases in which the Commission has sought to have lines placed underground. One is a line near Abbeystead, Lancs. which the Lancashire County Council wished to be underground for a length of about 670 yards out of a total of nine miles. The Area Board denied that amenities would be injured and said that even if a contribution towards the extra cost were received it could not be accepted because it would still be counted against the Board's capital allocation. After a public inquiry the Minister of Fuel and Power refused consent to the erection of this section overhead and the Board is now proceeding to put the line underground.

A temporary overhead line was erected across the top of the Malvern Hills by agreement with the Commission. The underground line to replace it has now been completed and was expected to be in operation by last month.

Route of 275 kV Line

Following a public inquiry into the erection of the 275 kV "super-grid" line from Newcastle to Carlisle the Minister signified his approval of the route with amendments previously agreed between the B.E.A. and the Commission. The Minister confirmed the view of the B.E.A. that a suggested alternative route presented practical difficulties. Subsequently the National Farmers' Union proposed another alteration in the route but upon being consulted by the B.E.A. and the Northumberland County Council the Commission said that it would be bound to oppose the alteration as the pylons would be made very much more conspicuous from the Roman Wall and Military Road.

Concern was felt at a proposal by the Merseyside and North Wales Electricity Board to erect a 33 kV overhead line between Machynlleth and Dolgelley through the Tal-y-Llyn Pass. An alternative route was suggested and although there were some access difficulties it was thought that these were not insuperable.

Against the Commission's opposition, the Minister consented to the erection of an overhead line in Martindale but gave an assurance that if the Commission asked him he would exercise his right of review (one of the standard conditions of his consent) at any time after the expiration of the five-year period.

The Commission represented to the Minister that the erection of a wind-power generator by the B.E.A. on the summit of

Mynydd Aneulog would seriously disfigure the whole headland. It was subsequently announced that the height of the apparatus had been modified from 130 to 100ft. The Minister still has the matter under consideration.

Fine Art Commission

Another report which touches upon the subject of electricity and local amenities is that of the Royal Fine Art Commission (H.M. Stationery Office, 9d). Advice is given by this Commission to the B.E.A. on the design of power stations. During the year designs were considered for the stations at Acton Lane (London), Bold (Lancs), Connah's Quay (Flints), East Yelland (Devon), Fleetwood (Lancs), Goldington (Beds), Marchwood (Hants), Meaford (Staffs), Portishead (Somerset), Roosecote (Lancs) and Tilbury; as well as for five stations mentioned in the last report—Carrington, Chadderton, Drakelow, Hackney and Uskmouth.

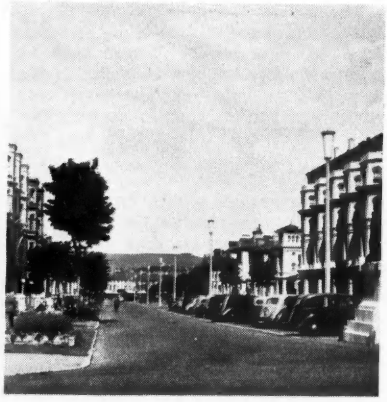
Street lighting is another matter in which the Commission has been concerned. It says that it has "tried to improve the standard of design, particularly for lamp posts, by advice to manufacturers through the Association of Public Lighting Engineers, but all too often the equipment chosen for particular areas is quite inappropriate and the combination of post and lantern incongruous." The Commission offers to advise authorities in cases of national importance.

In this connection the lighting of historic bridges is mentioned, as well as the lighting of trunk roads passing through places of outstanding architectural character.

"Boulevard" Lighting

DEVONSHIRE Place, Eastbourne, a typical boulevard type of street, is the main approach road from the shopping areas to the sea front, parades and bandstand. For many years, street lighting has been by means of 300 W filament lamps suspended by span wires across the 60ft carriageway. A new street lighting installation became urgent when it was found on examination that the steel poles supporting the span wires were deteriorating rapidly. The staff of the East Sussex and South West Kent Sub-Area of "Seeboard" was entrusted with the design of the new installation. Fluorescent lighting was decided upon and finally a vertical lantern, then in its prototype stage at the British Thomson-Houston Co.'s works, was selected. It was decided that the columns should be placed along the centre of the wide carriageway and that the spacing should not be more than 120ft. The lantern chosen houses six 3ft 30 W fluorescent tubes arranged vertically in a circle and enclosed by a clouded Perspex tapered cylinder. Concrete Utilities supplied the columns which were made up from a selected light shingle aggregate and then polished. The final mounting height was 25ft to the centre of the light source. Services were taken from l.v. distributors already available. Finally it was decided that the colour of the lamps should be a mixture of three natural and three white fluorescent tubes in each lantern as these were thought to give the best results for all purposes. The complete installation was put into operation immediately before the holding of the Illuminating Engineering Society's summer meeting at Eastbourne.

Fluorescent lighting by means of vertical lanterns at Devonshire Place, Eastbourne



Auckland Railway Electrification

THE New Zealand Cabinet has approved the appointment of British consulting engineers to advise on the electrification of Auckland's suburban railway system. The new system, key to a £20 million plan to modernize city and provincial services, involves the construction of New Zealand's first underground stations.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Vain Hope?

"IN the last few months practically everybody else in the electricity supply industry has successfully demanded higher pay." This quotation from your editorial observations (28th November) on the recent N.J.B. award can hardly be permitted to pass without reminding you of a small, but possibly necessary, body of employees of the B.E.A. and Area Boards who are still awaiting the great day when they will know their salary prospects in the industry. I refer, of course, to those who ultimately will be catered for in the Managerial Grades Agreement.

It was refreshing to find at least one glimmer of publicity on the state of the negotiations for managerial grades when, in a recent issue of your journal, you published a report of the A.M.E.E. annual meeting under the heading "A.M.E.E. Urges Salary Increase." The outcome of this "urge" has been an attempt to straighten out certain salary anomalies but apparently without any universal application.

The public notice issued by the B.E.A. in 1948 and subscribed by Lord Citrine intimated certain appointments to be made ranging from sub-area liaison officers to sub-area senior officers, appointments which are presumably to be governed by the Managerial Grades Agreement, and salary ranges were attached to each post. It is interesting to quote from the 6th paragraph of this notice as follows:—"Only a limited number of appointments will be made within the salary ranges indicated above. Appointments *below these levels* will be made at appropriate rates in line with existing agreements."

The words in italics would lead one to understand that the appointments referred to would be senior to those catered for in the N.J.B. and N.J.C. agreements and would naturally carry salaries appropriate to the grade of seniority. From your own advertisement columns it is quite apparent that many N.J.B. scale appointments are much more lucrative than those which are advertised as "subject to negotiation" and to be included in the managerial agreement.

The people concerned consist largely of individuals who have electricity supply in their blood (at least those of them who were "vested" from their previous electricity undertakings) and in several instances are the former engineers and managers of undertakings in which capacity they were the employers' representatives in most negotiations. With their long experience and accumulated knowledge of the industry, is it these facts that are causing them to be a bit tough when it comes to discussion with others who are not so experienced in achieving compromise as the outcome of negotiation?

Lord Citrine, with his wide knowledge of labour relations, should surely be able to guide his colleagues on the right lines. He has, in fact, been reported to refer to what has been achieved in the matter of negotiating machinery in the industry since he took over office but one must bear in mind that, before vesting date, negotiated salaries and conditions of service were available to all those engaged in the industry although, admittedly, there were some recalcitrant employers who were reluctant to submit to trade union agreements even for their senior staff, including managers.

The position to-day is that on approaching the end of the first five years there is still a section of the nationalized industry awaiting mutually agreed salary scales and conditions of service.

Lord Citrine has also been reported as saying that of all those employed by the B.E.A. and Area Boards fewer than 200 will hold non-negotiable appointments. Who are the non-negotiables and are they also working with a similar lack of conditions and agreed salaries as those of the "fourth leg"?

Should no settlement of the managerial problem be reached this year and the

Minister, in reviewing the appointments to Area Boards for the next term of office, decides to make some changes as he has done already in the Authority, will any new entrants to the field wish to review such negotiations as have taken place already and so cause further delays?

These are matters for the employees' representatives to consider but it would be rather welcome to receive some statements from the other members of the employees' tripartite additional to the statement already referred to by the A.M.E.E. In the meantime we remain the exclusive body of employees within the industry who have not, as yet, demanded higher pay. We await the outcome of some future mutual agreement.

MANAGERIAL MM/4144.

Electrical Installations

I ENDORSE Mr. V. R. Turner's remarks regarding the testing of electrical installations and the proposal that this should be carried out by a specially appointed national body.

A supply authority is authorized to permit installations to be connected to its system only if, in its opinion, the installation complies with certain conditions. How then is any other body or organization going to function, and how will the line of demarcation of authority be defined?

Having recently returned from South Africa, where one of my responsibilities was the establishment of an installation department for a supply authority, I would like to commend for consideration the practice of the City of Johannesburg in this connection. This was supported by suitable legislation and was followed by other municipalities in the Union I believe.

All electrical contractors were compelled to register with the supply authority, which in turn issued licences permitting them to carry out electrical contracting in the municipal area, or area of supply. Without such a licence it was an offence to do such work. The supply authority had powers to suspend or cancel any licence if the work of a contractor was consistently below standard or contravened the regulations. The effect of this procedure on the quality, and therefore the safety, of installations has been truly remarkable.

It is logical to suggest, therefore, that the supply authority ceases to take part in the commercial business of installation work. No unemployment would be caused since the building up of the necessary installation testing departments would absorb the present wiring and clerical staff. This, I consider, would indeed be a step forward in ensuring maximum safety to consumers.

Southport. G. S. CLARKE,
ASSOCIATE I.E.E.

Maximum Demand Tariffs

REFERRING to Lord Leathers' remarks recently in Parliament regarding conversations between the Ministry of Fuel and the B.E.A., I would like to emphasize the desirability of maximum demand tariffs being based on monthly, rather than annual—or in our case the period November–February (inclusive)—metered maximum demand.

It is obviously desirable to maintain a close control both of power consumption and of metered maximum demand, but once a high demand has been established during a cold spell jointly with a peak motor load, say, the consumer's interest in maintaining a good power factor is gone for another 8–12 months, instead of his developing a decided partiality towards compensating equipment such as capacitors, to the general good of the public by utilizing the cable network efficiently.

Richmond, Surrey. J. A. MCCASH.

"Caledonian Kilowatts"

IN the *Electrical Review* of 21st November Mr. A. M. F. Palmer, M.P., said that the Government's decision to attentively examine the supply of electricity in Scotland was "an adroit move on the part of the Government to appease Scottish Nationalist sentiment; if there can be no Home Rule for the Scots, there might at least be Home Rule for Caledonian kilowatts."

To-day with many people advocating the adoption of "Perpetual B.S.T." (eliminating double B.S.T., opposed by farmers, and consequently clock changes) we have in effect a choice of three time systems, including two practical and presumably acceptable (but from the power aspect very different) winter time systems.

Scotland and England are each plagued by the same peak and valley power problem; industry and the housewife are asked to stagger hours substantially because both countries work on the same time system.

Might not it be in both natural and

national interests for Scotland, a nation geographically more northerly than the Trans-Siberian Railway, to adopt say "perpetual B.S.T." as Scottish Time so virtually exchanging her peak-and-valley troubles for the blessing of two-way time-diversity power exchanges across the Border? Scottish, unlike French, grid connectors already exist and not under water. This may be unconventional but who solves by restriction what can be solved by common-sense time adjustment? Such an adjustment, however, takes years to effect; it took 300 years to get the Gregorian Calendar adopted. With a national 40 million ton coal deficit forecast within ten years and with capital expenditure restrictions severely limiting plant power programmes, can Scotland or England afford to wait so long?

Hove, Sussex. J. G. HEBDEN.

Domestic Heating

IT is a pity that "Reflector" (28th November) did not take the trouble to read my letter with a little more care, for his comments are without any foundation of truth.

The disposal of ash and the distribution of coal do not enter into the matter because I have not suggested any increase in coal consumption. Therefore, the present arrangements covering such services are not affected.

My letter was intended to clear up some of the muddled thinking which appears to exist in the electrical industry in regard to the use of electricity for domestic heating. The evidence given in my letter of 20th November makes it perfectly clear that to use electricity for such a purpose is wasteful and not in the national interest.

I may have been a little generous in my statement regarding the efficiency of solid fuel stoves, but I was generous also regarding the efficiency of the electricity generating industry.

Will "Reflector" deny that the overall thermal efficiency, i.e., heat into power station in form of fuel to heat obtained by consumer, is approximately 18 per cent? Let us face the facts.

When Mr. Burdett (14th November) puts his 25 kW house on full load he causes the power station to burn fuel at the rate of 39½ lb/hour assuming it uses coal of calorific value 12,000 B.Th.U./lb, and if he kept on full load for 24 hours, 8½ cwt of coal would have to be burnt.

Assuming that his average load (heating) is 5 kW continuous for the six winter months of the year and nothing for the remainder, he causes the power station to use 15 ton 6 cwt of coal in that period. I suggest that less than half this quantity of fuel burnt direct in his home would give him the same heat.

Luton, Beds. G. P. COOKE.

Ipswich Association's Dinner

AT the Red Lion Hotel, Colchester, last Friday the Ipswich and District Electrical Association held its annual dinner with the chairman, Mr. H. Richardson, presiding. The principal guest was Lieut. Gen. Sir Ronald Scobie (a director of British Insulated Callender's Cables, Ltd.), who proposed the toast of the Association. The speaker, after some interesting reminiscences, referred to signs of improvement in the country's position. Mentioning the Volta River (Gold Coast) scheme, Sir Ronald envisaged as a possible result a much greater use of aluminium for cables. Concluding, he commended Mr. H. E. Blakiston's idea of forming the Association which, he said, now had over a hundred members.

In his response, Mr. Richardson emphasized the representative character of the Association and paid particular tribute to the hon. secretary (Mr. H. P. Thompson) and hon. treasurer (Mr. W. H. Howell).

The toast of "The Electrical Industry" was proposed in an amusing manner by Mr. R. Geoffrey Smith (W. S. Cowell, Ltd.) and Mr. L. C. Penwill (director, Electrical Contractors' Association) replied. Among Mr. Penwill's points were the need to meet the challenge of the anti-electric forces now active, the protection of the public from shoddy appliances and installations and an appeal for greater production per man-hour. Mr. G. H. Blackburn, vice-chairman, wittily gave the health of "Our Customers" for whom Mr. H. H. Dawson (Ransomes, Sims & Jefferies, Ltd.) responded, making an appeal for simplicity in equipment design to facilitate operation and maintenance. The president of the Association, Mr. C. T. Melling, proposed "Our Guests" and Mr. G. A. Vowles (controller, B.E.A. Yorkshire Division) replied.

During the evening songs were sung by Martin Gluth (tenor) and Helen James (soprano).

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE South West Scotland Electricity Board has appointed **Mr. W. B. Mackay**, A.C.I.S., as accountant of Glasgow Sub-Area, to fill the vacancy created by the resignation of **Mr. J. R. Preshaw** to take up an appointment overseas. Mr. Mackay, who is at present accountant of the Ayrshire Sub-Area of the Board, was previously an assistant accountant in the Glasgow Sub-Area.

Mr. G. M. Couper, J.P., F.C.C.S., who holds the combined post of secretary and accountant of the Lanarkshire Sub-Area of the Board and was formerly secretary of the Clyde Valley Electrical Power Co., will retire at the end of March, 1953. The arrangement under which Mr. Couper holds both posts will come to an end with his retirement and the posts will thereafter be separately filled. The Board has accordingly appointed **Mr. W. R. McRobbie**, solicitor, to be sub-area secretary and **Mr. A. Dryburgh**, A.A.C.C.A., to be sub-area accountant. Mr. McRobbie is at present secretary of the Dumfries and Galloway Sub-Area of the Board and Mr. Dryburgh is administrative officer in the Chief Accountant's Department at Board headquarters.

The British Broadcasting Corporation has announced the retirement, on 18th November, of **Mr. R. J. Gilbert**, engineer-in-charge of the Ottringham transmitting station. Mr. Gilbert joined the staff of the B.B.C. at Savoy Hill as an assistant maintenance engineer in 1924. After serving at Plymouth and at the transmitting stations at Washford, Droitwich and Lisnagarvey, he became assistant engineer-in-charge at the Start Point transmitting station in 1939. He became engineer-in-charge at Stagshaw in 1942 and engineer-in-charge at Ottringham in 1945.

Sir William Robinson, J.P., is resigning from the chairmanship of the Northern Ireland Electricity Board, owing to pressure of business, and he will be succeeded on 1st January by **Mr. James Walker**, F.C.A. Sir William, who is managing director of Robertson, Ledlie, Ferguson & Co., Ltd., Belfast, has been chairman of the Electricity Board since 1944.

Mr. E. S. Waddington, F.S.E., A.M. (S.A.) I.Mech.E., M.Inst.W., Associate I.E.E., Associate (S.A.) I.E.E., of Philips Electrical Ltd. (Industrial Group), has been appointed by the Sheet Metal Users' Technical Association as its representative on the British Standards Institution Technical Committee WEE/24—Projection Welding in Mild Steel. Mr. Waddington has also been re-elected vice-chairman of the B.E.A.M.A. Arc Welding Plant Section.

Lord Citrine, chairman of the British Electricity Authority, made the presentation of the Carnegie Hero Fund Trust Award to **Mrs. Mary Patricia Fowler**, who was engaged as nursing sister at Hackney power station, at that station on 25th November. The award was in recognition of Mrs. Fowler's aid to a contractor's employee, engaged on painting building steelwork, who fell into a boiler coal bunker serving a boiler on load. The bunker contained some 180 tons of coal at the time of the accident, and Mrs. Fowler (although an expectant mother) climbed 60 ft of vertical laddering, donned a safety belt and was lowered on to the coal. Sinking almost to her waist in the coal she made her way to the man, attended to his injuries, and arranged

The presentation to Mrs. M. P. Fowler, showing (left to right), Lady Citrine, Mr. H. V. Pugh (divisional controller), Mrs. Fowler, Lord Citrine, and Mrs. H. V. Pugh

him on a stretcher until he was removed by the overhead telpher-crane. In addition to the Carnegie Award, Mrs. Fowler received H.M. Queen's Commendation. Lord Citrine also presented her with a cheque from the B.E.A. while other presentations were electrical appliances from the station staff and bouquets from her past nursing colleagues and the staff of the station.

Mr. Ian M. Gillett, general manager of Silentbloc, Ltd., has been appointed managing director. **Mr. Brian H. Dulanty** has been appointed to the board of the company.

Mr. S. A. Scadding, who has been assistant sales manager and publicity officer with J. & H. McLaren, Ltd., Leeds, for the past seven years, has relinquished his appointment to take up the position of general manager with the Northern General Supplies Co., Ltd., Leeds.

Mr. G. S. Rate, secretary of Ismay Lamps, Ltd., is retiring at the end of the year after forty-two years' continuous service.

Mrs. M. L. Pearce has been appointed a senior housecraft adviser with the English Electric Co., Ltd. Before the war she was an assistant demonstrator with the Central Sussex Electricity Co., Ltd., and then a demonstrator with the West Cambrian Power Co. & Associated Companies, Ltd. During the war Mrs. Pearce was with the F.A.N.Y. and had commissioned service in the A.A. After the war she became senior demonstrator to the Isle of Wight Electric Light and Power Co., Ltd., and then, until her present appointment, senior housecraft adviser to the Bristol Sub-Area of the South Western Electricity Board. She was the holder of the Caroline Haslett Travelling Exhibition in 1950, when she spent two months in France, studying home economics.

Mrs. M. L. Pearce

Mr. J. B. Greenwood has been appointed by Higgs Motors, Ltd., as technical sales engineer in the Leeds district.

Mr. H. C. Booth, F.C.G.I., M.I.C.E., who recently retired from the chairmanship of the British Vacuum Cleaner & Engineering Co., Ltd., was presented on 3rd December, at the Goblin Works, Leatherhead, with a gift of plate and a scroll by the directors and employees of the company. **Mr. J. J. Hambidge,** who made the presentation, spoke in felicitous terms of Mr. Booth's fifty-one years' association with the company, and Mr. Booth expressed his thanks for the gift.

Mr. J. J. Hambidge (right) presenting a scroll to Mr. H. C. Booth

Mr. L. Wall, Birmingham branch manager of Electrical Components, Ltd., has been elected to the Sutton Coldfield Town Council.

A new club room for the **Eastern Electricity Board's** Wembley District Sports and Social Club was opened on 17th November by Lord Citrine, chairman of the British Electricity Authority, who was accompanied by Lady Citrine. Mr. G. B. Pierpoint, district manager and president of the Club, opened the proceedings, and Lord Citrine made a short speech to which Mr. R. G. Eldred, chairman of the Club, replied. Among those present

This photograph, taken at the BEAMA Catalogue luncheon reported in last week's issue, shows Mr. H. R. Mackeson, Secretary for Overseas Trade, discussing the Catalogue with Sir Harry Railing, president of the B.E.A.M.A.

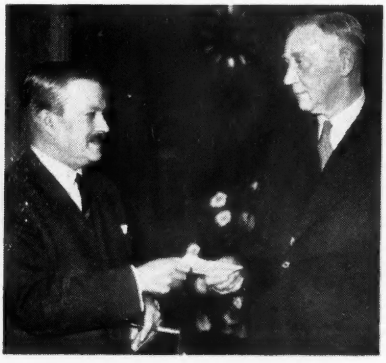
were Mr. C. T. Melling (chairman of the E.E.B.) and Mrs. Melling, Mr. H. Brierley (liaison and personnel officer), Mr. C. C. Hill (manager of the Northmet Sub-Area) and Mrs. Hill, and Mr. W. M. Maynard (deputy manager of the Northmet Sub-Area).

Presentation of long-service awards to N.E.E.B. employees. *Left to right:* **Mr. E. C. Lennox, Mr. H. H. Mullens, Mrs. G. Machin, Mr. G. Machin, Mrs. J. McCallum and Mr. J. McCallum**

The first presentation of gold watches as long-service awards to employees of the **North Eastern Electricity Board,** under the scheme adopted by the nationalized electricity supply industry, was made at South Shields on 28th November, by Mr. H. H. Mullens, chairman of the Board. The occasion marked the retirement of two employees. One of these was Mr. G. Machin, chief clerk for the South Shields district, whose service in the industry exceeded fifty-one years. The other was Mr. J. McCallum, who had thirty-nine years' service to his credit. Following the presentation of these awards, Mr. E. C. Lennox, manager of the Board's Wear Sub-Area, presented other gifts for which the colleagues of both recipients had subscribed.

At a small luncheon party at Oddenino's Hotel, London, on Monday, **Mr. E. Pulman** was presented with a cheque for £50 to mark his fifty years' service with Gent & Co., Ltd. The presentation was made by Mr. Kelvin Parsons, managing director of the company.

Mr. Kelvin Parsons, managing director of Gent & Co., Ltd., presenting a cheque to Mr. E. Pulman to mark his fifty years' service with the company



Mr. Pulman joined the company in September, 1902, being engaged mainly on wiring and installing electric clock and telephone systems, including those at the Old Bailey.

Mr. H. Copping, M.I.E.E., who recently resigned from the position of general home sales manager of Newman Industries, Ltd., sailed for Toronto in R.M.S. *Caronia* on 10th December. Mr. Copping is now associated with the Electric Construction Co., Ltd., and the British Overseas Engineering & Construction Corporation, Ltd.

Mr. H. Copping

On 2nd December at the Kingsway Hall, London, W.C.2, the **Lessa Music Society** (London Electricity Sports & Social Association) gave another of its successful choral and orchestral concerts. This time the main orchestral work was Mendelssohn's Italian Symphony and under the direction of Mr. Leslie Atkins a very creditable rendering resulted. The choir's principal contribution was Stanford's setting of Tennyson's "*The Revenge*" ably conducted by Mr. Douglas Sharpe. The soloists in a number of songs with the chorus were Margaret Wilby (soprano), Ernest Noakes (tenor) and David Hoon (baritone).

Following his marriage to Miss Mona Helen Cunningham, **Mr. Sebastian de Ferranti,** son of Sir Vincent de Ferranti, will be taking up residence in Toronto after a honeymoon in Venice.

VIEWS on the NEWS

By REFLECTOR

AFTER-DINNER oratory is by no means diminishing. At last week's annual dinner of the Ipswich and District Electrical Association at Colchester, there were eight speeches and although that may be considered a trifle excessive they were all worth listening to. A disadvantage was that they cut very short the subsequent reunion, which is a useful feature of such gatherings. The majority of the speakers adopted the lighter touch; one of them, Mr. R. Geoffrey Smith, suggested some desirable electrical devices including a memory jogger, a pigeon hole cleaner and (for Whitehall use) a red-tape cutter. Politicians, I think, might also welcome electric stone turners and automatic avenue explorers.

* * *

Giving a rather unfavourable reception to the pamphlet produced by Sir Arnold Gridley's group of M.P.s as a counterblast to anti-electric propaganda, the *Bolton Evening News* says:—

> "The more reasonable line taken by the gas industry that for some jobs gas is preferable and for others electricity, is more likely to appeal to the reasonable man."

It doesn't appeal to the reasonable electrical man or woman when the suggestion is that cooking and water heating, for instance, are pre-eminently jobs for gas.

* * *

A correspondent draws attention to a significant difference between two advertisements in an architectural paper. One presents gas as an almost indispensable factor in a laundry; it points out the many ways in which gas can be used and offers all available information on the subject. It is "promotional" advertising of a very effective kind. The other announcement comes from the B.E.A. It starts off on a cheerful note—more plant going into service and less restriction of demand by industrial and commercial consumers—but then it goes on to warn domestic and industrial consumers of possible winter troubles and it calls for restraint. The correspondent thinks that if he were an architect reading these advertisements he would feel inclined to use gas or solid fuel as far as possible. Can it be that the B.E.A. is overdoing its present exhortations and should now dare to suggest that people can use electricity without feeling furtive?

* * *

Objections have sometimes been heard that modern power stations are too much like cathedrals (and vice versa). There seems to be an echo of these in a remark by the Royal Fine Art Commission to the effect that "in some cases architects [of power stations] still seem to find difficulty in avoiding the kind of monumentality associated with less utilitarian structures, but a general improvement has been noted."

* * *

At a meeting of the Southend Town Council recently a member asserted that street lighting in Southend was "not up to the standard of efficiency one would expect in a borough of this size." If this is true it is strange for Southend is a place which prides itself upon its "illuminations." It may be of course that this is a matter of contrast—the brilliance of the illuminations may make quite good street lighting pale and insignificant.

* * *

When a lady contributor to the *Observer* advocated the installation of a radio set in the bathroom for the reception of the B.B.C.'s early morning transmissions, I thought that she was not only trying to end the old British custom of singing in one's bath but also introducing an element of danger. I am glad to see that the latter aspect is dealt with by another correspondent, but even he suggests that a battery-operated set might be used. I am against the practice on both grounds.

Austrian Power Progress

THE two dams closing the valley below the Pasterze Glacier, Austria, at 6,600ft above sea level to form an additional storage basin (the Margaritzenspeicher) for the Glockner-Kaprun Täuernkraftwerke power plant have been completed recently after 3½ years' building. The basin holds 662 million gallons of water which is led to a second basin (the Mooserbodenstausee) by a 7 miles long tunnel and will increase the output of the power plant by 187 million kWh a year. The larger of the two dams is 300ft high and on its crest 558ft long; the other is 137ft high and 565ft long.

Work on the Weissesperre, which is the highest barrage in Austria (some 7,500ft above sea level) and consequently one of the most difficult and dangerous to build, is nearing completion. The storage basin will raise the capacity of the Stubachtal, Tyrol, group of

Class	Consumption in Million kWh		
	1947	1950	1951
Industry	844·7	2,013·2	2,380·0
Public services ..	120·8	158·8	145·4
Transport	128·8	165·1	164·1
Domestic	516·3	515·7	558·3
Trades and crafts ..	199·4	266·2	451·0
Agriculture	82·1	93·5	108·1

power stations supplying the Federal Railways by nearly 40 million kWh to about 230 million kWh annually.

Expansion of power plants in Austria has enabled the country to increase consumption from 2,670·4 million kWh in 1947 to 4,874·5 million kWh in 1951. The main classes of consumption are shown in the accompanying table.

Royal Festival Hall

AT a Utilization Section meeting of the Institution of Electrical Engineers in London yesterday (Thursday) a paper prepared by Mr. J. G. Hunter (L.C.C.) was presented, which described the electrical installation in the Royal Festival Hall and illustrated some of the problems which were encountered in its design. Readers may remember that full details of this installation were given in the *Electrical Review* of 15th December, 1950 (pages 969–971).

Mr. Hunter dealt with lightning protection, the power installations and the primary, secondary and stage lighting, giving particular attention to the development of the dimming arrangements for the cold cathode lighting. The sound reinforcement and reproduction system was described in some detail by Mr. J. L. Goodwin in the *Electrical Review* of 29th February, 1952 (pages 437–442). Mr. Hunter also mentioned this system and referred to the arrangements for hearing aids, simultaneous interpretation, and an unorthodox type of interval signal. Other features of the installation are the provisions made for B.B.C. sound and television broadcasts, stage signalling, cueing systems and internal telephones.

Lighting Equipment Design

AT a joint meeting of the Liverpool Centre of the Illuminating Engineering Society and the Liverpool Architectural Society recently Mr. L. H. Hubble introduced a discussion on the design of interior lighting equipment. He said that to-day lighting had reached a position where it strongly influenced, and in some cases determined, interior design. This might be interpreted to mean that the architect was beginning to think in terms of brightness patterns as part of his design work. Similarly, the lighting engineer was becoming more conscious of his position as a collaborator in determining these brightness patterns and was at the same time responsible for converting lighting concepts into practical engineering terms. The work of the lighting equipment designer was becoming increasingly interrelated with the functions not only of the architect, the lighting engineer, the contractor and the maintenance engineer, but with the manufacture of lighting auxiliaries and lamps. The creation of new features and methods which could be standardized was the real challenge to the industry.

Evaluating Restriking Voltage

THE restriking voltage severity of a circuit is one of the important factors which need consideration when judging the short circuit performance of circuit breakers. Difficulty is, however, encountered when it is necessary to compare the severity of circuits producing three restriking voltage transients of greatly differing wave forms. A method of overcoming this difficulty has been evolved by the Association of Short Circuit Testing Authorities and is being considered by the International Electrotechnical Commission for incorporation, with certain minor modifications, in the next edition of the I.E.C. speification for a.c. circuit breakers. Pending the issue of this I.E.C. publication No. 56, a method of evaluating the severity of restriking voltage is set out in Interim Rules which provide a means of comparison on a uniform basis during the testing of circuit breakers at ASTA stations. Copies of these Interim Rules (ASTA No. 13) are obtainable from the Association of Short Circuit Testing Authorities, 36, Kingsway, London, W.C.2. price 5s net.

Electrical Research

New Publications Issued by the E.R.A.

DURING the period 1942–44 an investigation was made by the British Electrical and Allied Industries Research Association on the 66 kV system of the Shropshire, Worcestershire & Staffordshire Electric Power Co., to find the cause of troubles which had occurred on some of the lines following the installation of Petersen coils in 1940. About 170 switching tests were made and records taken by electromagnetic oscillograph, cathode ray oscillograph and klydonograph. E.R.A. Report Ref. S/T50 deals with the results of these tests. The cause of the trouble was traced to a small number of insulators of an obsolete type which were liable to flashovers on the occurrence of switching surges. After they had been replaced by a modern type no more trouble occurred.

Having regard to the large number of tests which had been made it has been considered desirable that a statistical survey should be made of the over-voltages recorded. This forms the subject of Report Ref. S/T60, "Statistical Survey of Over-voltages Observed During Switching Tests on a 66 kV System with Arc-Suppression Coil and with Resistor Earthing" (3s).

Testing Flameproof Motors

Report Ref. G/T265, "Flameproof Enclosure of Electrical Apparatus. Gaseous Explosions in Communicating Compartments: the Influence of Turbulence and Pressure Piling," by J. A. B. Horsley, O.B.E., M.I.E.E. (Ministry of Fuel and Power) (6s), reviews investigations carried out by the Safety in Mines Research Board recorded in S.M.R.B. Papers Nos. 10 and 49, published by H.M. Stationery Office in 1925 and 1929. This report has been prepared to present the scientific evidence upon which the routine testing of electric motors, as to flameproof enclosure, was based when the Mines Department of H.M. Board of Trade (since absorbed in the Ministry of Fuel and Power) took over that duty from the Mining Department of the University of Sheffield in 1931.

In brief, it was considered that the scientific evidence justified routine testing with the motor at rest, artificial means being used to simulate the effects of turbulence such as might be expected to result when the motor was running. The artifice used has been to keep the inflammable gas in circulation through the motor casing, by means of a fan, and to ignite the inflowing gas in a pocket outside the point of entry.

Lightning Current Measurement

It is now recognized that the information available on the amplitudes of lightning currents is subject to a certain ambiguity and that a re-evaluation of available data is advisable. In Report Ref. S/T57, "The Measurement of Lightning Currents. A Survey of the Present State of Knowledge," by R. H. Golde, A.M.I.E.E., and T. J. Brown, A.R.C.S., B.Sc. (12s), existing information is critically examined and it is concluded that additional data are required, particularly on the upper and lower limits of lightning current amplitudes. For this purpose a new installation of magnetic links on lightning conductors is being undertaken. A new method of evaluating possible current reversals in the lightning discharge is also discussed.

Report Ref. G/T256, "The Performance of A.C. Fuses with Small Over-Currents at 11 kV," by H. W. Baxter, B.Sc. (Eng.), A.M.I.E.E., and M. T. Cree (6s), is the tenth report in the series dealing with fundamental principles of fuse operation, those immediately preceding it being Refs. G/T245 and 246. It covers further consideration of problems arising on a range of current where operation is inherently difficult and also, unlike the previous reports, deals with tests at high voltage, viz., 11 kV, as compared with 200–400 V.

Report Ref. L/T252, "The Measurement of Permittivity at High Frequencies," by

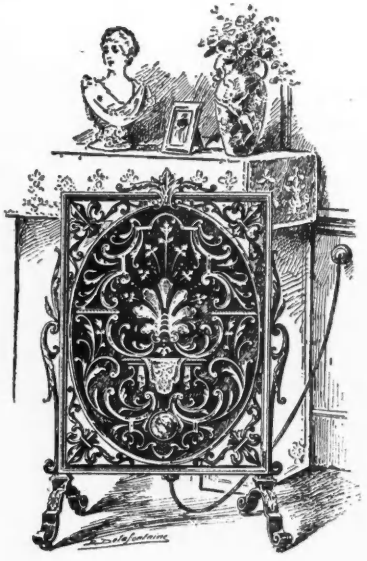
E. Rushton (N.P.L.) (6s), discusses the errors which may arise in the measurement of permittivity at frequencies of about 50 Mc/s upwards, when the method of reactance variation in a tuned circuit is used. The error is dependent on the permittivity of the material and the radius of the sample and is attributed to the effects of residual inductance in the circuit. The corrections to be applied in order to obtain the true permittivity are evaluated.

Copies of the above reports are available at the prices indicated in parentheses from the Electrical Research Association, Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

R.S.A. Journal's Centenary

THE 26th November issue of the *Journal of the Royal Society of Arts* marks the completion of a hundred years of publication. This formed the subject of the inaugural address of the chairman, Mr. E. Munro Runtz, F.R.I.C.S., earlier in the month when he quoted a number of interesting and amusing items from past issues.

His references included a report of the demonstration of the telephone given to the Society in 1877 by Alexander Graham Bell, when the chairman of the Society (Sir Richard Webster) said that they were "witnessing the beginning of an invention destined to produce enormous benefits in our social condition."



An ornate electric radiator illustrated in a Royal Society of Arts paper presented by R. E. Crompton in 1895

Quotations from some of the hundred volumes of the *Journal* are reproduced in the centenary number. There is an extract (with illustration) from a paper on the phonograph by W. H. (later Sir William) Preece who gave the first London public demonstration of the device. The picture which accompanies this note appeared in the 26th April, 1895, issue. It is taken from a paper read by R. E. Crompton on "The Use of Electricity for Cooking and Heating." From an account appearing in the *Electrical Review* at that time it seems that the elements which Crompton was employing were of nickel-steel alloy embedded in a composite enamel with a silica base.

Another quotation is from a paper by Guglielmo Marconi on "Syntonic Wireless Telegraphy" in which he announced his successful achievement of tuned wireless telegraphy.

Apart from these, the extracts cover many subjects ranging from the long-haired Angora goat to aeronautics.

Steam-Cooled Turbine Stator

TO reduce the amount of special steel in the stator of a steam turbine designed for high inlet temperatures and to permit the reduction of casing-wall thickness, a method of cooling the parts affected by means of steam at lower temperatures has been developed in the United States, it is reported in *Power*. In the application described stainless (austenitic) steel is used for parts in contact with steam at 1,100 deg F, which enters near the centre of the high-pressure cylinder to flow through the first blading stage. After a 180 deg turn the steam completes its journey through the cylinder and exhausts to an annular space between inner and outer shells at 700 deg F. The thinner and lighter walls enable the turbine to cope with load changes and starting and stopping more readily and facilitate inspection and maintenance.

Developments in Rumania

Plans for Power Expansion

By J. WILD

ELECTRICAL development in Rumania as planned will take ten years to complete. The proposals include an increase in installed capacity from 700 MW in 1950 to 1,700 MW in 1955 and to 2,600 MW in 1960. It provides for the construction of 13 thermo-electric stations (1,039 MW), 24 hydro-electric stations (764 MW) and a number of small stations (40 MW) and extensions to five existing thermo-electric stations (59 MW).

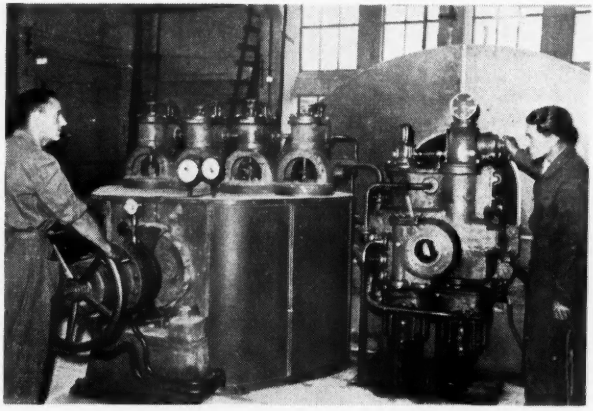
The chief construction project is the 210 MW "V. I. Lenin" hydro station using the River Bistritza in the Stejar Valley. Early in 1951, at Isvorul Montelui on a slope of the Botosanu Mountain, work began on the construction of the dam. On the sides of the dam two viaducts are to be built, one with a span of 35 metres (now completed), and the other with a span of 100 metres. The dam will feed the waters of the Bistritza into a reservoir 35 km in length and designed to hold between 1,400 million and 1,800 million cubic metres of water.

On the slope of the mountain facing Bicaz, a concrete tunnel 5 km long and 9 metres in diameter is being driven into the mountain by drilling crews, who have already bored through 200 metres of rock. At Stejar, on the corresponding slope of the mountain where the tunnel exit is to be, work is proceeding on a directional gallery and an auxiliary gallery. At a depth of 200 metres the two galleries will join, when work on the tunnel proper will begin.

The largest thermo-electric project is at Doicesti, scheduled for completion by the end of 1955, which will have an installed capacity of 120 MW. It is to supply electricity to Bucharest and to the oil wells and refineries of the Prahova and Arges regions. Work on the station is being speeded up because of its importance, and by last August 60 MW was in service. A hydro-electric station at Moroeni is to be in full operation by the end of this year and a 150 MW thermo-electric station at Petrosani is to be completed by 1955.

The whole of the electrification scheme is based upon the grouping of the country into seven regions: Muntenia, Oltenia, North and South Moldavia, and Central,

The "V. I. Lenin" hydro-electric power station at Bicaz under construction



Starting up a turbine at the Doicesti steam station in August last

North-West and South-West Transylvania systems. In 1950, because of bottle-necks and obsolete plant, only 600 MW of the 740 MW installed could be used. The uneconomic nature of the system was shown in the dispersal of the aggregate capacity among 603 stations, with an average of only 1·23 MW each. Power available varied from 0·5 to 6·8 kW per sq km, and from 7 to 71 W per inhabitant. Generation costs were high, over 70 per cent of the power being derived from petroleum and oil products. Under the electrification scheme more low-grade coal and coal waste will be used in thermal stations, and water power is to be increased by from 8 to 38 per cent of the present total installed capacity.

NEWS FROM BRAZIL

THE Companhia Brasileira de Aluminio is building a factory in S. Paulo, to treat 50,000 tons of aluminium ore annually. The necessary 280,000 h.p. will be taken from the Juquia River.

Two factories are to be erected in Brazil to produce electrolytic condensers for radio receivers, one by an American company, and another by a S. Paulo concern. Local production of receiving sets, which amounted to 100,000 in 1950, is expected to reach 500,000 this year. Eighteen factories and a large number of small assembly plants are operating. Prices, although still higher than those of imported sets, are reported to be coming down slowly.

Eight factories are turning out electric floor polishers in Brazil. Arno S.A., of S. Paulo, which builds electric motors to N.E.M.A. specifications, recently received an order for 6,000 floor polishers and is about to start making sleeve-bearing motors for refrigerators.

In August concessions were granted to Radio S.A. Mayrink Veiga and Radio Emissora Continental to install television stations in Rio de Janeiro.

The president of the newly-appointed Executive Commission for the Manufacture of Electrical Material (CEIME) announces that local conditions will permit the construction of generators and turbines of over 5,000 kVA and 5,000 h.p. respectively. British and American companies (Metropolitan-Vickers and Westinghouse Electric International) are prepared to co-operate with CEIME in developing heavy industry.

In view of the increasing shortage of power in Rio and S. Paulo, several firms have applied to the Bank of Brazil for permission to import motors and generators of over 100 kVA and diesel engines to operate with small generators, manufactured locally. The bank is granting licences to import diesel-electric generators, but only from countries with non-convertible currencies. Applications to import motor pumps and accessories for irrigation purposes are now receiving priority of treatment, but imports are only allowed against payment in non-convertible currencies. The bank has licensed imports this year from the United States (U.S. $3 million), United Kingdom (£91,000), France, Portugal and Sweden.

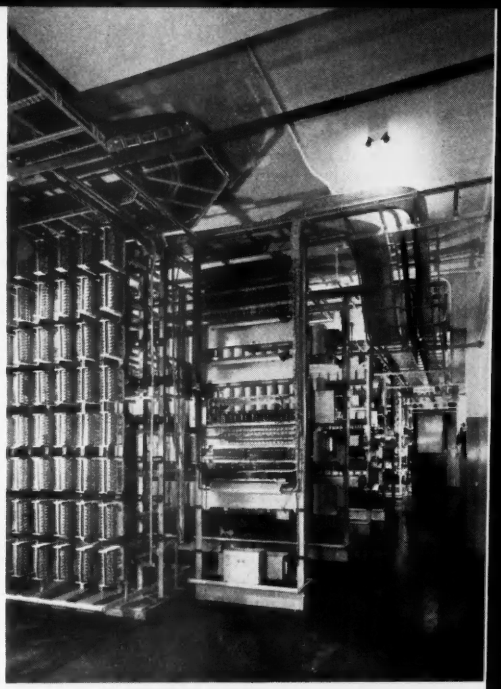
Works Telephone Exchange

New 1,700 Line Installation

A PRIVATE automatic telephone exchange believed to be the largest in the world has recently been put into operation at the Filton works of the Bristol Aeroplane Co., Ltd. It is a 1,700 line P.A.X. equipment made by the General Electric Co., Ltd., and installed by the Reliance Telephone Co., Ltd.

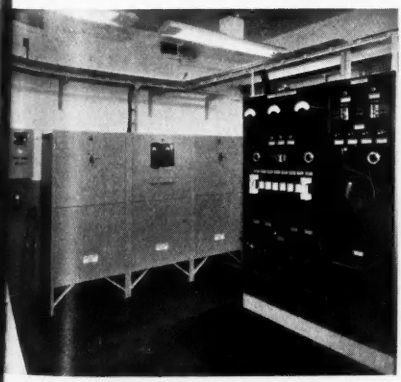
As in so many aircraft factories, the various divisions at Filton are separated by appreciable distances. Three G.E.C. automatic exchanges were previously used, linked together, but as the intercommunication load grew they became inadequate. Consequently, the company drew up a specification for a central 1,700 line automatic exchange with provision for the addition of a further 300 lines when needed.

The new exchange, employing preselectors, 1st and 2nd group selectors and final selectors, operates on a four-digit dialling system. A numbering problem arose immediately because the three exchanges already in use were numbered independently and thus a major change of many numbers was apparently necessary. The problem was solved by keeping the existing three digits of the individual extensions and using the fourth digit of the new system as a prefix.



General view of the 1,700 line P.A.X. at Filton, showing racks and cable runs

The power room, with ringing machines on the left, battery charging equipment and main switchboard



The exchange equipment follows normal rack mounting practice but a rack height limit of 8ft 6in and the presence of rolled steel joists in the ceiling caused some modification to the normal cable layouts. Otherwise the exchange is laid out normally. Automatic audible and visible alarms indicate faults such as fuse, release, permanent glow, handsets left off their stands for long periods without dialling, etc. Bells and light signals provide warning and identification of faulty circuits.

The ringing machine is mains driven, as is the spare. In addition a battery driven ringing machine is also installed to take care of a mains failure, power being provided by two 50 V 600 Ah batteries. All

the normal test equipment including a graduated howler is fitted and two engineers are on duty in the exchange during the day with one at night.

During the installation period these engineers, under the direction of the Bristol Aeroplane Co.'s Electrical Engineering Department, assisted the Reliance Telephone Co.'s staff. So successful was the planning of the installation that the actual change-over to the new central exchange was carried out with an interruption to the internal telephone service lasting only 20 minutes.

The Faraday Lecture

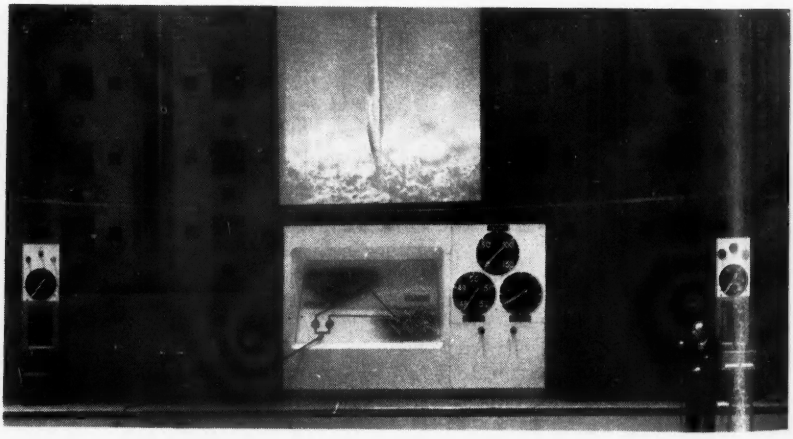
MORE than 2,400 people were present on 24th November at the new Free Trade Hall, Manchester, to hear Mr. A. R. Cooper (controller of the B.E.A. North Western Division) deliver the first of this year's series of the I.E.E. Faraday Lecture. The subject was "Light from the Dark Ages or the Evolution of Electricity Supply" and the lecture was illustrated by experiments, scale models, lantern slides and films showing the development, size and complexity of modern boilers, turbines, electricity supply systems and the national grid control.

Discussing the problems facing the control engineer, Mr. Cooper said that deciding if and when to shed the load was only one of his tasks; the next day's demand had to be carefully predicted. For example, a drop in load of 50 per cent during the two minutes' silence on Armistice Day had to be allowed for to prevent the disturbing sound of boilers blowing off. The effect on the load of boxing contests in America was also demonstrated.

With the aid of a coloured film, lent by the American Embassy, the trapping of sunlight by chlorophyll in green plants was explained and the heat stored by this process was shown being converted into work by models of Hero's turbine and the impulse turbine. Faraday's electromagnetic induction experiment was also reproduced.

Possible future sources of electricity, such as the use of wind power, differences in temperature between the top and the bottom of the ocean and the internal heat of the earth were mentioned. More significant developments might come from the "fuel cell" in the conversion of coal into electricity without using steam boilers, turbines or generators.

Mr. Cooper's Faraday Lecture demonstration apparatus



Railway Overhead Equipment

Methods of Construction Discussed

IN a paper on the economic aspects of overhead equipment for d.c. railway electrification, presented on 4th December at an ordinary meeting of the Institution of Electrical Engineers, Messrs. O. J. Crompton and G. A. Wallace (British Insulated Callender's Construction Co., Ltd.) made a number of recommendations, based upon experience at home and abroad, for achieving a reduction in costs. A typical scheme using 0·75 sq in conductors was taken in which single-track mileage consisted of 40 per cent open-line tangent track, 20 per cent open-line curved track and 40 per cent complicated junction work with sidings equipment.

At £7,350 per mile for tangent track, the average cost per single-track mile was £10,850 overall, except for survey and bonding. Possible methods of reducing expenditure on individual items were worked out, figures being based upon costs at 1st January, 1952, which allowed £231/ton for copper wire bars, £21 15s 6d/ton for steel joists and 2s 8d an hour for unskilled field labour.

The measures indicated in the paper would, the authors calculate, save £1,950 per single-track mile with a further £450 if the copper section were reduced to 0·62 sq in. Recommendations included reduced wind loading, increased stresses in steel, a 6 : 3 : 1 concrete mix, increased pressure on foundations at 4 to 6in depth in good ground to 1,200 lb/sq ft, maximum open-line spans of 240ft, cap-and-pin insulators throughout, simple droppers, elimination of turnbuckles and reduced sectioning.

DISCUSSION

Mr. C. M. Cock (English Electric Co.) opened the discussion by saying that general electrification of the railways in Great Britain would save at least 8½ million tons of good-quality coal per annum. Electric locomotives were the most efficient of all types of locomotive and the cheapest to maintain, but they required an expensive fixed installation. Of the total cost of overhead equipment roughly two-fifths was absorbed in erection costs. To reduce these, the greatest possible uninterrupted time should be given for the installation of foundations and steelwork and the line conductors and careful study should be given to the design and construction of special machinery for this purpose. Attention should also be given to some of the lighter forms of construction employed on the Continent.

Bold Approach Needed

Mr. S. B. Warder (British Railways) pointed out that if electrification had developed in this country in the way expected when the 1931 Weir Report was produced, many of the problems discussed in the paper would have been resolved years ago; but, largely due to prejudice and lack of imagination in and outside the railways, nothing had been done apart from the third-rail system on the Southern Railway. The result had been that in 1951 another report had been necessary on whether the 1,500 V d.c. system was the correct one for this country and, unless a start were made soon, a further report might be needed on whether this was still the case, in the light of subsequent developments. If electrification provided the only hope of modernizing the railways it should be faced boldly and not on a hand-to-mouth basis: a continuous policy of electrification was required.

Mr. E. van der Hoek (Netherlands Railways) described what was being done in Holland, where a very simple form of construction had been adopted, involving the use of 60ft stitch wires at each structure instead of an auxiliary catenary throughout the system. The distance between overlap spans was about one mile, as in England, but the construction of the overlap span without switching equipment was very simple and used only the normal posts and supports. The distance between supports on open double track had been standardized

at 236ft, based on a maximum wind velocity of 79 m.p.h., and allowed for a maximum operating speed of 87 m.p.h. Taking British prices, electrification on the Netherlands system would still be 15 per cent cheaper than on the English system. Between 1948 and 1952 920 track miles had been electrified and to-day in Holland over 800 miles of double track had been electrified, representing 40 per cent of the whole system.

Pre-stressed Concrete Structures

Mr. Maas Geesteranus (Netherlands Railways) mentioned that pre-stressed concrete structures had been used on a large scale on 272 miles of route recently electrified; they had the advantage that little in the way of protective coating was necessary. In 1949 a normal open-line type of structure cost £46, while in the same year the cost of a steel structure without protective coating was £39. Prefabricated blocks were now being used for foundations, being put into position by a crane mounted on a flat wagon at an average rate of 40 per day. They provided cheaper and better concrete, more rapid handling and no dirtying of the ballast. He said that there were three standard types of foundation blocks and five types of anchor blocks.

Mr. H. H. Swift (British Railways) pointed out that when the specification for the Shenfield scheme was drawn up in 1937 the contract price for the overhead line equipment was about one-third of that given in the paper. It had always been expected that the electrification would be extended to Southend, Colchester, Enfield and Broxbourne, and provision had accordingly been made for high-speed electric locomotives as well as suburban services. He hoped it might prove possible to reduce the total equivalent copper, but that would depend on whether a greater voltage could be tolerated. The Shenfield and Manchester–Sheffield specifications were based on a 10 per cent voltage drop, but Mr. Swift considered that it might be possible to go higher than this.

Mr. J. A. Broughall (British Railways) said that where the authors had made a positive recommendation he would be prepared to recommend British Railways to adopt it. He hoped that experiments now being made on the Manchester–Sheffield line would enable a decision to be taken on matters still in doubt, such as the use of stitch catenary construction. There was a danger of under-estimating the total effect of the savings which could be made in various ways, particularly if electrification was carried out in a big way and not in "penny numbers."

Mr. W. J. Nicholls (Aluminium Wire & Cable Co.) supported the authors' plea for a thinner minimum thickness of steel by pointing out that almost all the grid towers originally erected had a minimum thickness for some members of $\frac{3}{16}$ in. Some of those towers had not been galvanized originally but had lasted very well, so that $\frac{1}{4}$in seemed a reasonable minimum. He also suggested that composite structures with an aluminium alloy beam and steel legs might have advantages.

Dr. H. 1. Andrews (British Railways) referred to the advantages of relaxation methods for calculating the stresses of overhead line structures, and Mr. J. C. Hill suggested cutting out overhead structures altogether by the use of diesel-electric traction. Messrs. W. A. Hatch and A. J. Smith also made short contributions to the discussion.

Authors' Replies

Mr. G. A. Wallace, in reply, referred to the use of high-voltage a.c. and said that with this the overhead equipment would certainly be cheaper, but account had to be taken of the very high cost of altering overbridges and tunnels to get the clearances required for h.v. equipment and the difficulty of maintaining a.c. equipment in tunnels used by steam traffic. Two galvanized structures had been erected on the Shenfield route to see whether galvanizing would withstand the sulphurous atmosphere of a railway which also carried steam traffic, and so far they had stood up very well.

Mr. O. J. Crompton, who also replied, said that the prices for overhead equipment given in the Cock Report should not be used in making estimates for future electrification schemes; he considered them misleading. The figure of £6,100 for an average mile of 1,500 V d.c. electrification should in his view be about £7,500. He regarded the compound catenary as a better proposition than stitch wire construction; it provided the stitch wire effect at the structure and also added to the conductivity of the line as a whole.

Commerce and Industry

Marking of Imported Goods

Tenders for Washington and Seattle Contracts

THE *Board of Trade Journal* of 6th December points out that regulations concerning the marking of imported goods which fell into abeyance and were partially suspended during the war have recently come into full force again. Importers and sellers are accordingly warned of their responsibility of seeing that those goods in respect of which marking Orders have been made under the Merchandise Marks Acts bear proper indications of their origin.

The Customs and Excise authorities, Custom House, Lower Thames Street, London, E.C.3, have issued a new list of goods subject to marking Orders with particulars of the marking methods which must be applied. Included among these goods are electric lamps, cables and wires, meter parts, portable lamp cases, electrical accessories, synchronous clock movements, radio equipment (including valves) and insulating tape.

Small Generators for Canada

A firm of machinery suppliers in Vancouver, British Columbia, tell us that they already have a selling agency for a comprehensive range of British-made diesel engines but at present have no arrangements for obtaining generating equipment from this country. They are anxious to obtain a line of 5–100 kW d.c. and a.c. generators to incorporate with their engines as lighting plants for use in rural districts. As regards the a.c. generators they would prefer machines with compensated windings to eliminate the necessity for automatic voltage regulators. It is stressed that the equipment should be as simple as possible in view of service difficulties.

We shall be pleased to pass on to our inquirers any information or offers which British manufacturers may care to send us.

Football Ground Floodlighting

Work has begun on the installation of floodlighting equipment at the Newcastle United football ground at St. James' Park, and the first floodlit match on this ground is expected to be played early in the New Year. Contractors for the installation are Fletcher Bros., of 63, Blackett Street, Newcastle-on-Tyne, 1. They are erecting eight poles on each side of the pitch, each pole carrying at a height of about 52ft five Philips "Winchester" narrow beam floodlights using 1,000 W Class B.1 projector lamps. Auxiliary lighting will be provided by another forty Philips fittings and lamps of various types.

Cable Ship

Swan Hunter and Wigham Richardson, Ltd., Walker-on-Tyne, are to begin work next year on the construction of another cable ship of 3,300 tons gross for Cable & Wireless, Ltd. Earlier this year the cable ship *Stanley Angwin* was completed. The new order will be the twenty-third cable ship built by Swan Hunters.

Underwater Television Order

The first export order for British underwater television equipment calls for the supply of Marconi–Siebe Gorman equipment to Jugoslavia. The order has been placed by the Belgrade shipping material imports company of Brodoimpeks for dock and harbour inspection work in Jugoslavia's Adriatic ports.

Exhibition of Standard Motors

The success which attended the introduction last spring of the LY standard motor range is being brought home to engineers and others at a

At the English Electric Newcastle exhibition of standard motors. *Left to right:* **Mr. F. C. Winfield (Merz & McLellan), Mr. C. Horne (manager, dynamo and motor sales, English Electric Co., Ltd.), and Mr. H. Watson-Jones (president, Association of Mining Electrical and Mechanical Engineers)**

series of English Electric exhibitions. Mr. H. Watson-Jones, president of the Association of Mining Electrical and Mechanical Engineers, was among a number of distinguished visitors who went to the one held in Newcastle-on-Tyne recently.

Electric Heating Reduces Costs

James Arnott & Sons, Ltd., oil importers and manufacturers, Newcastle-on-Tyne, have reduced costs by using an electric heater for melting solid material in steel drums. Previously the contents of the drums were melted by steam, the time taken for three-ton batches of drums being 5½ hours and the cost 12s. With an electric heater the time taken is 2½ hours and the cost 1s 6d.

G.E.C. Handbook

In September last, when the first handbook produced by the General Electric Co., Ltd., since 1935 made its appearance, it was stated that a special overseas edition was being produced. This adds a special 190-page supplement to the 800-page "home" volume. It contains fully-illustrated particulars and dimensions of typical examples of the company's switchgear, fuse-gear, transformers, motors and control equipment, generating plant, welding equipment, cables, overhead line materials, lighting fittings, furnaces, telephone systems, etc. The information is so designed as to simplify ordering for the overseas engineer.

Standard Voltages for India

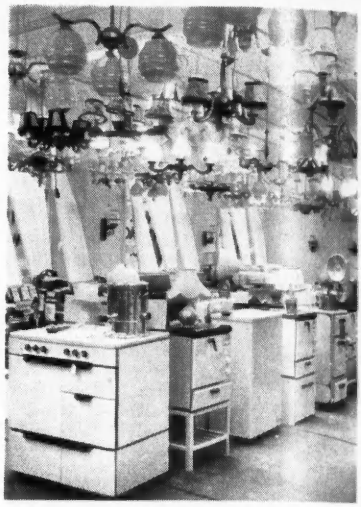
Indian Trade and Industry reports that a draft specification for standard voltages has been circulated for comment by the Indian Standards Institution, Delhi. The preferred a.c. voltages are 115, 230 and 460. For l.v. systems (below 1 kV) they are 240/415 V. Higher recommended voltages are 3·3, 11, 22, 33, 66, 132, 264 and 275 kV, the last two being tentative "to be confirmed in the light of experience which may be gained in other countries." A standard frequency of 50 c/s is recommended.

Duke at Electrolux Works

With Her Majesty the Queen, the Duke of Edinburgh recently spent the week-end as guest of Sir H. A. Wernher, Bt., chairman of Electrolux, Ltd. On the following Monday the Duke made a private visit to the Electrolux factory at Luton.

Northern Wholesalers' Showrooms

New trade showrooms, which have recently been opened by W. H. Armytage, Ltd., electrical factors, etc., at Bridge Street and Chapel Lane, Bradford, are among the largest in the provinces. At the moment there is 300 sq yd of showrooms; when completed, they will cover an area of 500 sq yd, while an additional 480 sq yd



Part of the new Bradford showrooms of W. H. Armytage, Ltd.

is available for future development. Each manufacturer of the electrical goods displayed has had an individual stand placed at his disposal, and in addition to a wide range of lighting glassware, domestic electrical appliances of every description are on show. The business has been in existence since 1907 when Mr. W. H. Armytage and partner first opened a retail shop. The concern now covers the whole of the country and a fleet of vans enables a regular service to be given to all districts.

American Bureau's Report

The annual report for 1951 of the U.S. National Bureau of Standards (Miscellaneous Publication No. 204) is an illustrated summary of scientific and engineering investigations conducted by the Bureau last year, giving not only accounts of current activities but also detailed descriptions of some of the more important developments within the fifteen technical divisions of the Bureau. The report is obtainable from the U.S. Government Printing Office, Washington 25, D.C., for 50 cents plus postage.

Hydraulic Research

In a paper presented at a meeting of the Institution of Mechanical Engineers on 28th November Mr. Herbert Addison described the evolution of equipment in the hydraulic laboratory of the Fouad I University, Giza, Egypt, from its inception in 1926 to the opening of the new building in 1952. Particulars were given

of some of the experimental apparatus, with comments based on experience in the interrelation between instruction and research, including that necessary to meet post-graduate needs.

Goods for New Zealand

The principal of a well-known firm of New Zealand importers is visiting this country next year and requires offers for a wide range of items of electrical equipment including cables and wires and domestic appliances. We shall be pleased to pass on any communications from interested British exporters.

Improved Lamp Pack

The General Electric Co., Ltd., has introduced an improved pack for "Osram" general lighting service lamps in 25, 40, 60 and 100 W ratings. The new pack provides extra protection and rigidity and, at the same time, the opportunity has been taken to improve appearance and sales appeal.

Individual lamp sleeves of the present type, but without end discs, are inserted into outer sleeves that bear a description of the contents on one side. Taking two or three lamps each, these sleeves in turn are packed into 100-way cartons. A 100-way carton will thus contain 20 two-way packs and 20 three-way packs, so that however many lamps have to be sold at one time, the number can be provided by a combination of two- and three-way packs. The new packs stack neatly in stock bins.

British Tenders for American Projects

The English Electric Export and Trading Co., Ltd., has submitted the lowest tender for a contract to manufacture four generators for the Chief Joseph Dam at Bridgeport, Washington, U.S.A., and two transformers for a new substation in Seattle. The four generators will be of 60,000 kW each. According to the *Daily Telegraph*, the English Electric bid £1,570,000 on the generator contract. The next lowest tenders were from the Westinghouse Electric Corporation with £1,770,000, and the American General Electric with just under £1,890,000. The Seattle district office of the United States Army Engineers states that a decision will be made shortly on the award of the contract. The English Electric Co. bid £247,000 on the Seattle city contract, the next lowest being that of the Pennsylvania Transformer Co., £290,000.

Unfair Competition Alleged

At a recent meeting of Tunbridge Wells Town Council, Councillor H. A. Sheppard voiced the opinion that it was unfair to other electrical traders to permit the South Eastern Electricity Board to stage an exhibition of electrical apparatus in a council house on an estate at Sherwood Park, Tunbridge Wells, now being developed by the Corporation. The matter arose on an item in the minutes of the Housing Committee in which it was recorded that the housing manager had referred to that Committee a request received from the South Eastern Electricity Board for permission to arrange an exhibition of electrical apparatus in a house on the Sherwood Park estate and to circularize prospective council tenants with an invitation to view the exhibition. The Housing Committee suggested that permission be granted, and in moving disagreement with this proposal Councillor Sheppard said that "Seeboard" was now in open competition with other electrical traders in the town, and should not be granted facilities not available to other traders—whether in the electrical or furnishing or other trades. He also questioned the advisability of permitting what was in effect a trade exhibition to be held in a council house. The motion of disagreement was defeated by 16 votes to 8 after the chairman of the Housing Committee, Ald. F. S. Harries, had pointed out that this was the only application received for such facilities and that should there be other applications they would have the same consideration.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £166 0s 0d
COPPER, H.C. Electro	ton £285 0s 0d
Fire Refined 99·70 per cent ..	ton £282 10s 0d
Fire Refined 99·50 per cent ..	ton £274 0s 0d
COPPER Tubes	lb 2s 8½d
Sheet	ton £340 0s 0d
H.C. wire and strip	ton £336 0s 0d
LEAD, English	ton £96 15s 0d
Foreign	ton £95 0s 0d
MERCURY	flask £70 10s 0d
TIN	ton £951 0s 0d
ZINC, G.O.B. Foreign	ton £110 0s 0d
Electrolytic	ton £114 0s 0d
BRASS Tubes	lb 2s 2¾d
Sheet	ton £277 15s 0d
Wire	lb 2s 8¾d
PHOSPHOR BRONZE	
Wire	lb 4s 1½d
RUBBER, No. 1 R.S.S. spot ..	lb 27¼d–28d

Paper Mill Supply

After eighteen hours' work by employees of the North of Scotland Hydro-Electric Board, the Donside Paper Company's mill, Aberdeen, which employs 300 people, was able to restart on 3rd December, after a four-day stoppage due to a breakdown in the plant. Normally the mill generates its own power from a single steam turbo-alternator with a small stand-by supply from the Board during the week-end. The steam generator, which is eighteen years old, broke down the previous week and is likely to be out of commission for several months. The company asked for a supply of 1,200 kW. A squad of twenty workmen from the Board,

assisted by workmen from the mill, started work at 7.30 a.m. on 1st December to install an additional 1,000 kVA transformer and erect about 200 yd of h.v. cable between buildings and high voltage circuit breakers. The Board's employees stopped at 5 p.m. on 2nd December to fit in with the work on the mechanical drives, etc., which was being done by the mill's employees. They continued their work on the Wednesday.

Changes in Export Licensing

A Board of Trade Order which makes changes in export licensing control comes into operation on 17th December. Licences will now be required for all destinations for non-ferrous welding electrodes. Licences will also be required for recording oscillographs and optical (disappearing filaments) and radiation type pyrometers for all destinations other than the Commonwealth (excluding Hong Kong), the United States and the Irish Republic. Licences are not now required, except for exports to China, Hong Kong and Tibet, for lead-acid accumulators and parts.

E.A.W. Diplomas

The E.A.W. diploma in Electrical Housecraft for Demonstrators, endorsed for all three subjects, cookery demonstration, laundry demonstration and salesmanship, has been awarded to Mrs. M. Alcorn and Mrs. J. M. Carter of Preston, and Miss J. M. Dean of Huddersfield. The diploma endorsed for cookery demonstration has been awarded to Miss A. Brown and Mrs. M. Jones of Bristol, and endorsed for salesmanship to Mrs. Candy of Bedford.

Trade Announcements

Mr. H. B. Oakes has been appointed by **Ekco-Ensign Electric, Ltd.**, as its representative for certain southern areas of Yorkshire. He will operate from the company's northern sales office, Preston.

Mr. P. M. King, late of Simpson, Baker & Co., Ltd., and Mr. J. B. Clarkson, late of the Post Office Telephones, Birmingham, have joined the staff of **Electrical Engineering Supplies (B'ham.), Ltd.**, and will represent the company in the Warwickshire, Worcestershire and Staffordshire areas.

The Valve Division of the **Marconiphone Co., Ltd.**, has been transferred from Hayes to London. All correspondence, orders, etc., should now be sent to E.M.I. Sales & Service, Ltd., Valve Division, 3, Stanhope Street, London, N.W.1 (telephone : Euston 8051).

A. C. Morrison (Engineers), Ltd., Loughborough, have appointed Mr. Joseph Muller, P.O. Box 243, Haifa, as their agent in Israel, and Sardar Uttam Singh Dugal & Co., Ltd., 11, Marina Arcade, New Delhi, as their agents for N.W. India and Assam.

An attractive new display carton has been introduced by **Metway Electrical Industries, Ltd.**, for its kettle connector No. 909.

The **Agro Electrical Co., Ltd.**, has appointed Mr. N. B. Croft, 12-14, St. George's Street, Belfast, as its agent in Northern Ireland.

The main offices of **Sarum Electric, Ltd.**, are now at Catherine Court, Catherine Street, Salisbury. The telephone number is unchanged.

Catalogues and Lists

Ekco-Ensign Electric, Ltd., Preston House, 45, Essex Street, London, W.C.2.—Illustrated priced catalogues on industrial lighting equipment and diffusing glass fittings for use with tungsten lamps.

Hotpoint Electric Appliance Co., Ltd., Crown House, Aldwych, London, W.C.2.—Priced leaflet illustrating the Hotpoint " Torribar " safety kettle (HK.140).

A. F. Bulgin & Co., Ltd., By-Pass Road, Barking, Essex.—Six leaflets dealing with flasher units, pilot lamp-holders, appliance connectors, chassis plugs and sockets and mains signal lamp fittings.

Insuloid Manufacturing Co., Ltd., Sharston Works, Leestone Road, Wythenshawe, Manchester.—Two folders illustrating " Plasklip " insulated cable clips and " Ring Lock " bushes.

British Insulated Callender's Cables, Ltd., Norfolk House, Norfolk Street, London, W.C.2.—28-page illustrated booklet dealing with " Bestos " A.V.C. cables (318) and a 36-page booklet on " Bicalex " winding wires (322).

Samuel Taylor, Ltd., 72-74, Lionel Street, Birmingham, 3.—Illustrated folder dealing with " Steb " metal for electrical contacts.

Hanovia, Ltd., Slough, Bucks.—Leaflet showing the many versions of display items available to dealers.

" Diamond H " Switches, Ltd., Gunnersbury Avenue, London, W.4.—Brochure No. 7 illustrating the new 30 A size rotary packet type switch.

Stephen Glover & Co., Tudor House, Bridge Street, Walsall.—Illustrated leaflet dealing with " Infralite " infra-red heating units for pig breeding and poultry raising and an illustrated catalogue of wrought iron lighting fittings, including price list.

LIFT DRIVE

Description of an A.C./D.C. Arrangement

AN a.c./d.c. lift drive has been developed by E. A. Foulds, Ltd., Colne, Lancs, to provide, at a reasonable cost, an electrical method of driving direct from the a.c. mains, either single-, two- or three-phase, which will give a performance at least equal to variable voltage control. It is particularly suitable for lifts in the higher speed ranges and where, on the heavier capacity slower speed types, automatic self levelling is required.

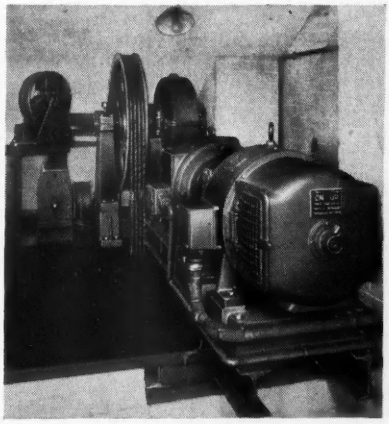
The system consists of standard a.c. and d.c. motors connected together either directly, by vee belt or other means. Usually, the a.c. main driving motor is coupled to the worm reduction gear, and the d.c. pilot motor is then mounted on a hinged bed with electric interlock, in the case of the vee belt drive, to break circuit in the event of the belts stretching abnormally or failing. In certain cases, the motors are directly coupled. The vee belt method of coupling has advantages as it obviates the use of specially long bedplates with the resulting mechanical difficulties of lining up three units, saves space and, more important still, the mechanical advantage of the vee belt drive reduces the h.p. of the pilot motor and, consequently, the rectifier size for the pilot motor armature. A higher speed ratio is also possible. Mechanical losses due to continually driving the pilot motor are offset by increasing the mechanical efficiency of the reduction gear by a modification of the worm spiral angle, so that the overall efficiency is not less than that of a lift having a single motor. The system scores here over a motor generator set as the conversion losses cannot be mechanically offset in quite the same way and retain a self sustaining feature.

The usual speed of the a.c. driving motor is 960 r.p.m. and the d.c. pilot motor is normally based on 480 r.p.m. Assuming the a.c. motor is of 12 h.p. with a starting torque of 200 per cent, then a d.c. motor giving equivalent torque at 480 r.p.m. would be 6 h.p. A mechanical advantage of 1·33:1 would rate the motor at 4·5 h.p.; a 5 h.p. machine would be used. When the lift is running at full speed, the pilot motor would idle at 1,280 r.p.m. With the standard 240 V pilot motor, the full load current would be 21 A and with 50 V across the armature, this would be 1·05 kW. Allowing for starting, a 2 kW rectifier would be of ample capacity for the armature. About 500 W at 240 V is also necessary for the shunt field and the controller.

The speeds would then be 960 r.p.m. on the a.c. motor, 60 r.p.m. on the pilot motor, resulting in 45 r.p.m. on the main motor with a vee belt drive ratio of 1·33:1, giving a ratio of 960–45 r.p.m., which will ensure a creeping speed low enough for good levelling even on the fastest geared lifts.

Any control system can be used providing automatic slowing and stopping, such as collective calling systems, auto-pilot car switch, push button, combination of auto-pilot and push button. The power section of the controller comprises a reverser for both motors, main contactor, high speed contactor, accelerating contactors or rheostat, low speed armature contactor, field relay, high speed relay and the usual protective relays. With typical push-button

Typical winding gear for the a.c./d.c. lift drive



control, the sequence of operations upon pressing a push-button is: the latch relay coil and the master relay coil are energized which in turn operate the high speed relay, reversing contactors, maintaining relay, and the main contactor, the latter bringing in the high speed contactor and rheostat. The brake is released and the main motor accelerates to full speed, at the same time driving the pilot motor.

Slowing and Levelling

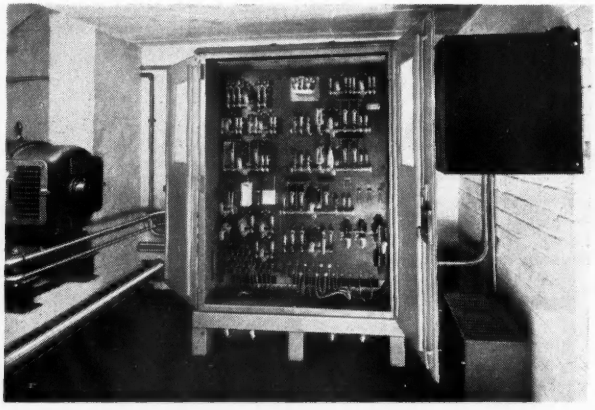
To prevent generation during the idling period, the pilot motor series field is short circuited by a so-called "suicide" contact on the high speed contactor and the shunt field open circuited except for the by-pass discharge rectifier. When the lift car approaches the floor level, the high speed contactor has its circuit broken through the medium of the floor selector and high speed relay. The levelling switch and its relays take charge and retain direction or reverse as necessary. On breaking circuit, the high speed contactor re-makes the contact feeding the pilot motor shunt field in conjunction with a delay relay which has a double wound coil allowing it to lag for a pre-set time. For the first instant of slowing, the d.c. motor generates, the excitation being provided by the series field. The purpose of this arrangement is to keep the slowing distance constant with varying loads as the greater the load driving the lift and the greater the corresponding dynamic braking effort.

The dynamic braking can be finely controlled both by timing the delay relay and adjusting the resistor and required slowing obtained. When the d.c. motor has slowed down to the point when the generated e.m.f. equals but does not exceed the armature rectifier voltage, the armature contactor closes and low speed is attained. Final cut-off at floor level is by the levelling switch and ramps operating it. In the event of an overrun, the circuit is re-made and the car brought to floor level at low speed. For the protection of the motor and equipment, a time limit relay is provided which limits the time the contactors may remain closed to 20 sec longer than the time taken for the longest trip. Overload releases are also fitted.

The acceleration and slowing of this drive is extremely smooth and quiet in action and the wear and tear of the equipment is reduced to the minimum, particularly the magnetic brake, which stops the motor at very low speed and can almost be regarded as simply a holding brake. From the safety point, if the brake failed, the constant dynamic braking feature would prevent the lift motors building up speed. It has been found on test that a lift running at full speed will slow down and stop if the current is switched off and the brake released.

A substantial number of lifts have been installed with this drive and have proved very successful. A number of the installations under passenger-attendant control are making up to 150 starts per hour without trouble and with very little maintenance. Drives including 25 h.p. main motors have been provided. One installation, a goods lift, which has a capacity of 2 tons and a speed of 150ft/min, has a levelling performance of within ¼in from no load to 25 per cent overload, and the variation in slowing with differing loads does not exceed 6in. The slowing takes place in about 2ft 6in and the final distance at low speed is about 2in. The system is patented in the United Kingdom, the United States and Canada.

Controller for a.c./d.c. lift drive



Smithfield Show

Special Interest in Grain Drying and Refrigeration

THOUGH following so closely after the Dairy and Commercial Motor Shows, the Smithfield Show and Agricultural Machinery Exhibition, being held this week at Earls Court, London, includes a surprisingly large amount of electrically operated equipment not previously displayed. The comprehensive range of appliances shown covers almost every conceivable need of the farmer to assist him in the cultivation of his land, the care of his stock, and the storage, handling and marketing of his produce.

Grain Dryers

Interest is particularly noticeable in grain drying and refrigeration, the former being the subject of the entire exhibit of the British Electrical Development Association. This display includes replicas of a platform type in-sack grain dryer unit, and an in-silo ventilated grain drying and storage unit. A full-size silo, allied to a 60 ton plant, is seen with a Gandley fan and heater unit and pneumatic and trough conveyors arranged to provide a continuous grain circuit. Another section houses a platform dryer having a G.E.C. fan and heater unit suitable for a 20 hole plant with a moisture extraction rate of 0·6 per cent per hour. An electrically operated Cooch winnower fed by a Michigan elevator is also seen in this section, together with Marconi and "Kaybee" (infra-red) moisture meters. All equipment is shown working.

The new Mark I "Lincoln" all-electric grain dryer is introduced by Penney & Porter, Ltd., together with the "Syren" seed treater and the "Lincoln" winnower. New grain and grass dryers are also shown by the Alvan Blanch Development Co., Ltd., together with grain handling equipment, elevators, hoists and a portable electric forge specially suitable for the farm workshop. A grain drying attachment for a grass dryer is a new product of the Templewood Engineering Co., Ltd. Lainchbury & Sons, Ltd., claim that their new "Convoy" grain dryer is dustless, noiseless and non-damaging to the corn. With working models of in-bin and in-sack drying Geo. W. King, Ltd., demonstrate a new sack hoist, a development of the "MyTeMin" electric chain pulley block with a capacity of 280 lb and a lifting speed of 75ft/min. Besides infra-red moisture testers T. R. Walker's new equipment includes hammer mills, precleaners, separators, seed graders and counters, and germinating cabinets. A new hammer mill made by Scottish Mechanical Light Industries, Ltd., is claimed to grind two tons of oats per hour into cattle feed.

The new tray model Purlac in-churn milk cooler cools churns down to 50 deg F in approximately ten minutes. Iced water is pumped from the cabinet to one or more turbine milk coolers placed on full churns on a tray. The water runs down the sides of the churns, is collected in the tray and is automatically returned to the icing cabinet. The apparatus, which can be used in conjunction with any ordinary surface cooler, takes up extremely little space and no churn lift is required.

Refrigeration Equipment

Among refrigeration equipment Prestcold have a new range of display cases, while Frigidaire show some new self-service display cases. The application of the "Sternetic" refrigeration system to cold rooms and 25 cu ft and 40 cu ft service cabinets is demonstrated by L. Sterne & Co., Ltd. The "NCB" mobile electric butcher's shop shown by Smith's Electric Vehicles, Ltd., and designed for inside service, is free of purchase tax.

The latest addition to the range of electric fencing accessories manufactured by the Wolseley Sheep Shearing Machine Co., Ltd., is a fencing post, which requires no separate insulator, the wire being passed through the insulated loop at the top.

A new lighting set shown by Bamfords, Ltd., is designed for remote control, while the new B/4/DX generating plant manufactured by Dale Electric (Yorkshire), Ltd.,

is claimed to be the cheapest 4 kW semi-automatic generating plant on the market. A lightweight petrol driven battery charging set is a new "Alco" product shown by Arthur Lyon & Co. (Engineers), Ltd.

The exhibition closes this evening (Friday).

Fans in Agriculture

AT an open meeting held this week in the Richmond Hall, Earls Court, during the Smithfield Show and Agricultural Machinery Exhibition (8th to 12th December) a paper with the above title was read by Messrs. W. Cover and R. C. Dick (both with the G.E.C.).

The authors commenced by differentiating between the several available types of fan and then indicating their respective characteristics in some detail, because they maintained that only proper appreciation of the differences between respective characteristics would ensure that the most suitable type of fan was applied to particular agricultural needs.

The importance of selecting the correct motor for driving each of the distinctive types of fan in general use, namely propeller, axial flow and centrifugal, was emphasized. The motors should be totally enclosed for all agricultural uses. Frequently a standard industrial motor was employed for driving a fan, but it must be realized that fan duty was abnormal; wherever practicable, therefore, it was desirable to employ a motor designed and rated for the particular fan duty.

Some fundamental fan laws were stated and the subjects of resistance to air flow, as well as details of air pressure, were explained at some length. Applications were dealt with more briefly, broadly grouped under four headings, namely, drying, handling, storage of crops (including potatoes) and miscellaneous uses.

When dealing with grain drying, the fact was mentioned that most continuous and batch dryers were repetition production machines so that their design details were the concern of the fan manufacturer; whereas in the case of in-silo and platform dryers each plant might be designed to suit the individual farmer's requirements. In-silo and platform plants, both of which employed safe, low temperatures, were described in some detail. An important point which should not be overlooked was that a platform dryer could be used for treating grain, seeds and hay and there seemed little doubt that in future, with slight modifications, they might also be used for drying grass. This type of dryer might therefore prove to be an inexpensive general crop dryer for the small farmer.

Some of the disadvantages of the outdoor clamp method of storing potatoes were referred to; the paper explained that by the provision of ventilation during selected periods of the twenty-four hours it was possible to maintain potatoes at a lower temperature than would be possible in a clamp in the field. Ventilation for this purpose, however, should be used only in favourable weather conditions. Miscellaneous uses of fans included the ventilation of farm buildings and farmhouses as a means of maintaining satisfactory working conditions for both farm animals and workers.

STREET LIGHTING PLANS

WALSALL Public Works Committee recommends, subject to loan sanction, etc., the provision of mercury vapour lighting on eighty-four 25ft poles in Sneyd Lane and Lichfield Road, Bloxwich, at an estimated cost of £6,300.

STOKE NEWINGTON Highways and Town Planning Committee is seeking permission to carry out a further conversion of street lighting from gas to electricity in the Brownswood Park area. It is proposed to use 80 W mercury vapour lamps. The estimated cost is £7,215.

Street lighting is being installed at MILVERTON (Som.) following approval of the Council's plans by the Ministry of Transport.

CLEVEDON Finance Committee has approved a scheme for changing the town's street lighting from gas to electricity. A motion was carried by 10 votes to 2 authorizing application for a loan large enough to pay for the additional 50 lamps so long as the total repayments did not amount to more than £2,700 a year—the amount of the present gas bill.

WELLINGTON (Salop) Urban District Council is to be asked to accept a tender for £5,413 for the conversion of street gas lamps to electricity, including the installation of class A lighting on the Holyhead Road.

A proposal to convert 404 street gas lamps to electric lighting at a cost of £13,000 is being submitted to WEST BROMWICH Town Council.

HEYWOOD Corporation is applying to the Ministry of Transport for permission to convert side street lighting from gas to electricity at an estimated cost of £4,000.

BARNSTAPLE Corporation has approved the provision of improved lighting in the Pannier Market.

ELECTRICITY SUPPLY

Economical Boiler Repair

Reply to Tariff Criticisms

As several boiler drums at Chamber Hall generating station, Bury, after undergoing hydraulic pressure tests recently, showed serious cracks in the circumferential seams, 280 rivets were removed from one of the affected drums for a magnetic test. This test was carried out with the aid of gamma radiography.

The cost of removing the defective drums to the makers' works for repairs would have been prohibitive but a local firm of boiler makers agreed with the B.E.A. (N.W. Division) engineers that replacement of the existing concave ends by convex ends on site would provide a cure.

Three drum ends on one boiler were affected. This entailed complete removal and the "cropping" of the ends of each drum for drilling new rivet holes for seating the new convex ends. This boiler has now passed its hydraulic test and another boiler is being similarly dealt with. The boilers at this veteran station have thus been given a new lease of life at small cost.

Winnipeg Acquisition Offer

Details of a proposal by the Manitoba Government to purchase the hydro-electric assets of the Winnipeg Electric Company have been made known in a formal offer sent to common shareholders. The Government offers shareholders $20,622,098 in cash, together with certificates of interest in shares of the transit and gas utilities operated by the company in the Greater Winnipeg area. The Government also proposes to take over the total bonded indebtedness of the company ($27,600,000) and $5,000,000 in preferred shares, bringing the total cost to the province for the hydro assets to about $53,200,000. Acceptance of the offer is recommended by the president of the company and a committee of four principal shareholders.

Large Canadian Switching Station

The Montreal North switching station, largest such unit undertaken by the Quebec Hydro-Electric Commission, was officially opened recently by the Hon. J. S. Bourque, Minister of Lands and Forests. The new station embraces the latest electrical and operating features, many being tried for the first time in Canada, and will extend dealings with the Shawinigan Falls power house, power being transferred from Shawinigan through Montreal North to Ste. Rose. It has been designed for long-term expansion, and will close the 120 kV loop system circling the city, providing power for large industries. Six 120 kV transmission lines terminate at the station, with two lines capable of transmitting about 250,000 kW from the Beauharnois scheme.

Earthing Fault

The tenants of a number of houses of Bellingham (Northumberland) U.D.C. at Wark received an electric shock when they touched their water taps. The electricity system was earthed to the water pipes and the shocks, which were not severe, are stated to have been caused by a fault in the earthing system. Earthing tubes are being installed to replace the present method.

Belfast Power Station Cost

Belfast Corporation, at its meeting on 1st December, decided to apply to the Ministry of Commerce for sanction to the raising of a supplementary loan of £926,750 to cover the cost of the initial installation at the Victoria power station. The acting city electrical engineer reported that revised estimates amounted to £5,142,500, which exceeded by £926,750 expenditure already sanctioned. The chairman of the Electricity Committee said he would make a statement explaining the position at the next meeting.

South Wales Tariff Review

The chairman of the South Wales Electricity Board, Mr. Leonard Howles, in an interim review of the new tariffs, assured a Cardiff meeting of the Consultative Council last week that the Board was already giving attention to criticisms. But he stressed that there had to be some stability "without a change of tariff every five minutes." Care had to be exercised in dealing with a few hardships not to alter the tariff in such a way as to create many more hardships. He felt that by reviewing the charges over a full year consumers would get an answer that, in many cases, was very different from what they feared when they had their first bill under the new tariff. One important point that people had overlooked was that the

very form of the new tariff tended to even up the quarterly bills by increasing those in summer and by reducing winter bills, other things being equal.

Observing that the results of the first quarter were very much as expected, he said preliminary examination would be made of some points already emerging from consultations with the Council and from Press correspondence. The three major points were: the consumer in a very small house, usually referred to as "the old age pensioner," who thought he paid more than he should; tenants of larger houses who also felt penalized by the number of rooms; and the dispute about when a scullery or kitchen was not a scullery or kitchen. He indicated that the Board would re-examine this "constant scullery problem in South Wales" to see if some fairer basis existed. The Board was also examining a criticism that the commercial block grant did not merge smoothly into the two-part tariff and was inequitable at some stages.

He did not want members to get the idea that there was an enormous number of anomalies in the new tariff. The Board had had agitation from only about three areas—not against the actual operation of the tariff but because the bills had increased through standardization. The Board welcomed really objective criticism but much that had been received was misinformed.

Rural Development in South Wales

The first three stages of the South Wales Electricity Board's rural development plan are expected to be completed by April next year, according to a statement by the Board last week. Stage 4 comprises secondary and local distribution works at an estimated total cost of £280,728, and Stage 5 covers similar works to the extent of £258,200. Considerable extension and reinforcement of the primary h.v. lines of the distribution system in rural areas will proceed in addition to the work outlined in the proposals (the cost of this primary distribution is not included in the figures just mentioned, nor is the cost of connection of consumers in rural areas through the normal extension of existing networks). The Board adds that it is not practicable at this stage to attach a specific time-table to the proposed works.

Castle Donington Station

It is expected that the new power station, which is to be built at Castle Donington at a cost of between 30 and 35 million pounds and will be the largest in Europe, will be generating electricity in 1956. The installed capacity of the completed station will be 600,000 kW.

Irish Hydro-Electric Scheme

The waters of the River Lee are to be harnessed to produce electricity for Cork and adjoining counties. The scheme, which will take four years to complete, involves the flooding of almost 4,000 acres of land and erection of two power stations at Innisheara, nine miles upstream from Cork, and at Carrigadrohide, ten miles farther upstream. The estimated cost of the scheme is £2,259,000.

Electricity Areas

The monthly *Electrical Industries* has produced for its subscribers a large map of England, Wales and Scotland showing in a good deal of detail the fourteen Electricity Areas and the Sub-Areas into which they are divided as well as the territory of the North of Scotland Hydro-Electric Board.

Mains Extensions

Wallsend Town Council has approved plans by the North Eastern Electricity Board for l.v. underground cables to supply 112 houses and one shop in Holly Avenue; 6 kV underground cables to the works of Victor Products, Ltd.; and underground cables to supply 144 houses on Low Willington Farm estate.

Shildon (Co. Durham) U.D.C. is in touch with the North Eastern Electricity Board regarding the proposed supply of electricity to the village of Brusselton.

Cumberland County Council has approved proposals by the North Western Electricity Board for the construction of overhead lines to the village of Easton in the Wigton rural area, and extensions to the 33 kV overhead line from Penrith to Newby in Westmorland.

Coronation Lighting Schemes

St. Pancras Borough Council Coronation Committee has approved the floodlighting of the Town Hall, St. Pancras Church and the Old St. Pancras Church at a cost of £100, and the floodlighting of St. Pancras, Tavistock Square, Euston Square, Harrington Square and the Highgate Road gardens with ornamental lighting, involving the purchase of additional floodlighting equipment costing £1,000.

Subject to the approval of the City Council, Belfast City Hall, with numerous outdoor statues, the Albert Memorial and the two War Memorials will be floodlit in colour.

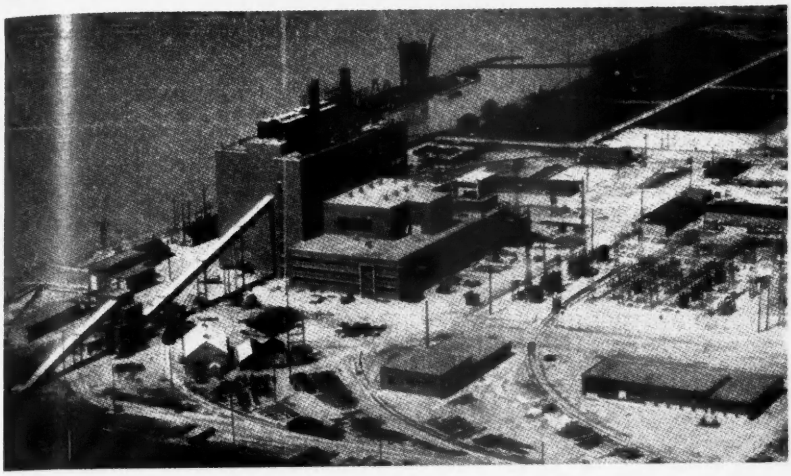
Walsall Trolley-Bus Experiment

A single-decker Glasgow trolley-bus is to be tried out at Walsall for an experimental period in the New Year. Its chief feature is a separate exit system which enables the conductor to remain in full control at all times. It will operate on the Bloxwich route and if the bus is suited to local conditions, a fleet may be bought.

Profit from Illuminations

It was reported at a recent meeting of Leamington Illuminations Committee that the "Lights" season in the Jephson Gardens resulted in the estimated profit of £6,260 being exceeded.

ONTARIO COMMISSION'S REPORT



Plant Capacity Increased by 211,450 kW

THE forty-fourth annual report of the Hydro-Electric Power Commission of Ontario has just come to hand and in his "letter of transmittal" to the Hon. Louis O. Briethaupt, Lieutenant-Governor of Ontario, Mr. Robert H. Saunders, C.B.E., Q.C., chairman of the Commission, refers particularly to the advisory council named by the Prime Minister during the year. This Council consists of eight men and one woman, all highly capable persons representing a cross-section of Ontario's life and industry.

The Commission operates three major power systems, namely: the Southern Ontario system, which serves the older and more populous part of Ontario, the peninsula enclosed by the lakes Huron, Erie and Ontario, and the St. Lawrence and Ottawa rivers; the Thunder Bay system, which serves the smaller area at the lake-head on the north western shore of Lake Superior; and the Northern Ontario Properties system, which embraces both the north eastern and north western regions, excluding the Thunder Bay system.

The total assets of the Commission in respect of all these systems amounted to $1,036 million after the deduction of an accumulated depreciation of $117 million. Capital expenditure by the Commission during the year under review amounted to $164·6 million, and 51 per cent of this was spent on new generation. Of the $39·4 million which was spent on frequency standardization, $6·8 million was devoted to future standardization.

To meet these expenditures and to provide a debt retirement of $10·5 million, $130 million of bonds were issued during the year. There was a long-term debt of $690·3 million at the end of the year, while accumulated sinking funds amounted to $165·6 million at that time.

The maximum plant capacity of all sources was increased during the year to 2,941,750 kW which included extensions to the hydro-electric stations and new fuel consuming stations. This figure represented an increase of 211,450 kW over that at the end of the previous year.

The Commission's plant generated during the year a total of 14,025·6 million kWh, while the authority purchased under various agreements another 4,785·8 million kWh, this figure being an increase of 18·5 per cent over that for the previous year.

In the Southern Ontario system the

Above: **The 264,000 kW J. Clark Keith station was commissioned with its first set during 1951**

eighth and final generating set was commissioned at the Des Joachims generating station, as were the remaining six of the eight sets at Chenaux.

Towards the end of the year the Richard L. Hearn generating station was commissioned with its first 88,000 kW Parsons set and likewise the J. Clark Keith generating station was put on load with its first English Electric set. The second set of the Richard L. Hearn steam power station will have a capacity of 100,000 kW, while the final capacity of the four sets at the J. Clark Keith power station will be 264,000 kW. These major developments resulted in a maximum plant capacity for the system of 2,389,250 kW at the end of the year, this being an increase of 208,250 kW or 9·5 per cent above the figure for December, 1950. The total energy produced by the system during the year amounted to 15,286·4 million kWh, an increase of 18·7 per cent.

In the Thunder Bay system there was an increase of 18·4 per cent of electricity generated during the year, representing 1,578·3 million kWh from the Nipigon River stations, the recently constructed Aguasabon and Pine Portage developments and Kakabeka generating station which was acquired in 1949.

The maximum demand on the system of 192,415 kW represented an increase of 12,705 kW over the figure for 1950.

Revisions of the plant ratings resulted in a maximum plant capacity of the Northern Ontario Properties system of 317,400 kW at the end of the year. The total energy generated by this system in 1951 was 1,946·8 million kWh, representing an increase of 16·6 per cent.

The maximum demand on the system was 286,653 kW, an increase of 10·9 per cent above the figure for 1950. The resources of the Thunder Bay system and the Patricia district of the Northern Ontario Properties system were integrated early in the year by the commissioning of a 115 kV transmission line between the Moose Lake and Dryden transformer stations.

The supply of energy to Killarney represented a considerable engineering achievement for in the 18 miles stretch of line between Birch Island and Killarney there are 29 water crossings, including one with a span over a mile long and three submarine cable crossings.

Recording Instruments

I.E.E. Measurements Section Discussion

WHEN he opened a discussion on recording instruments at a Measurements Section meeting of the Institution of Electrical Engineers in London on 2nd December, Mr. W. Bamford (Everett, Edgecumbe & Co., Ltd.) limited his remarks to direct recording instruments employing an electrical movement as the primary measuring or controlling device. With the aid of slides and demonstration instruments he considered the measuring element or marker drive, the marking device, the chart or recording medium, and the chart drive. He also discussed servo-operated markers, the dimensions of graphers, and special types of graphic instruments.

Each of the ten contributors to the discussion spoke on different aspects of the subject, the first describing the trend of customers' requirements during recent years. There was now less insistence on circular charts, although these could be stored on a spike, and used on both sides, unlike the strip or roll type. Neater panels had been achieved by using a single multi-channel roll type grapher leaving only small indicating instruments for the supervisory observation of each channel. An alternative arrangement, now finding favour, was to retain a grapher for each channel but to reduce their size by accepting a chart 2in wide instead of the 10in size.

The second speaker referred to inherent objections to recording on paper and was interested in the system of ejecting ink from the pen as referred to above. A combination of the heat and light types of recording methods, using infra-red light on a heat-sensitive material, was suggested.

Researches into the properties of chart paper and into substitutes were described by the third speaker. Except under laboratory conditions, paper could be made only in a manner resulting in a grain, which lay along the length of roll-type charts. The fibres swelled most in their width, so that variations in humidity, even in this country, could change the chart width by 1·5 per cent. Circular charts became oval. Plastic dressings were considered as stabilizers but proved on test to be themselves unstable, and no alternative to paper was found. It was pointed out that in making circular charts, the first side was printed co-incidentally with the punching of the centre hole, so that in printing the second side this condition for ensuring register did not obtain.

Slides were used by the next speaker to show exploded views of a moving coil instrument for recording by electrolytic means. A 6 cm pen gave a deflection of 1·4 cm with an accuracy of up to 90 c/s. For a 9 cm pen the corresponding figures were 2 cm and 60 c/s. Another system employed a tubular pen in which ink flow depended upon capillary effect combined with the centrifugal effect arising from the excursions of the pen and aided by pneumatic pressure on the ink reservoir. The pumping solenoid was de-energized when the grapher was switched off, allowing a spring to deflect the diaphragm, thus retaining the ink in the capillary tube by suction.

The speaker believed that the ejection type of pen noted by a previous speaker used ink pressures of 10,000 lb/sq in. He had seen the light-sensitive method used by running photographic paper out of the developer and over a hot drum, drying it ready for inspection, without fixing, in a few seconds. With heat-sensitive methods he had found that the provision of highly-rated pen ligatures became a problem.

An instrument using electro-sensitive starch-iodide paper was described by the fifth speaker. A scan voltage was applied to a scanning stylus and through electronic circuits the signal caused a mark at a distance across the channels and the speed of response was satisfactory.

Another speaker referred to the use by Electricité de France of a transient grapher whose running was initiated by high speed selective relays. The chart consisted of 35 or 70 mm cellulose acetate film, yielding eight or sixteen channels, coated with carbon black in resin. The scriber produced a fine line capable of optical magnification 50 times. The movements were of the moving-iron type, each requiring an input of about one watt for full excursion, with good response up to 800 c/s.

One speaker mentioned that by maintaining an air pressure inside the case of a normal instrument it had been made acceptable for use in inflammable atmospheres, and he and the next speaker suggested that the daily examination of plant records might be simplified by using a magnetic transient recorder.

The final speaker agreed that more daily charts were produced than could be conveniently studied or stored and suggested the use of integrating instruments, perhaps in conjunction with printometers. There were also applications in which a simple grapher, arranged to give warning of serious deviations, and perhaps with erasable markings, would be adequate.

Micro-Wave Radiation Hazards

POSSIBLE industrial hazards from high frequencies used with electronic equipment have been investigated by Messrs. H. M. Hines and J. E. Randall of the College of Medicine, Iowa. In an account of the authors' experiments given in *Electrical Engineering* (the journal of the American Institute of Electrical Engineers) it is stated that the biological effects are attributable to temperature changes, although the possibility of non-thermal causes should not be completely ruled out. Four major factors are: the parts of the body exposed to irradiation and the efficiency of their mechanisms for heat elimination; intensity of radiation energy; duration of exposure; specific frequency of radiation.

Tests carried out with radiations at 1,600, 75, 12, 8 and 3 cm showed that shorter electromagnetic waves increased temperatures in superficial tissues, while longer wavelengths affected those at greater depth. Certain bodily parts degenerated with even short exposures. Thus a direct single exposure of rabbits' eyes to 12 cm waves at 5 cm distance for 15 minutes with 100 W of power output resulted in the formation of cataract-like lesions in the lenses of the eyes after delays of three to nine days. The human body (particularly certain parts) can be shielded from high energy outputs of electromagnetic waves by covering the surfaces of vulnerable parts with close fitting copper or bronze wire screens.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Brook Motors, Ltd.—In his review of the year ended 30th September last, published with the report and accounts, Mr. F. V. Brook (chairman and joint managing director) says that the virtual collapse of export markets through lack of sterling, especially Australia, created a rapid change in the order book with the result that to-day goods of standard type can, in the majority of cases, be obtained from stock or on short delivery terms. The material position has also improved. Direct exports have been difficult; trade with the United States has not developed to the extent forecast, but if present negotiations with an established sales company succeed, it should be possible to give a more encouraging report on this market next year. The temporary closing of the Australian market was the greatest setback, although that trade is now improving. The hardest markets are now the Continent, where German competition is severe, and Egypt, where in spite of the political upheaval their representatives have kept the company's sale of their products alive, although on a reduced demand. In the home market there are definite signs of a trade revival. The new factory at Barnsley is completed, but commencement of production is handicapped by the late delivery of certain essential equipment. Full production should be possible, however, by the end of the present year. In addition to motor winding, they intended to transfer their control gear production from Huddersfield. A new building for research is practically completed, and should be in full use by the end of this year. During the year they have introduced a new totally enclosed fan cooled machine and a comprehensive range of motors designed to British Standard specification, at present in draft form.

The report includes a number of illustrations of the company's works and products.

Aerialite, Ltd.—The annual meeting will be held on 17th December. In his statement which accompanies the report and accounts, Mr. L. S. Hargreaves (chairman and managing director) says that turnover has increased by 25 per cent. They have many new products on the market and in development which show great promise. Output has been restricted by factory space, but a licence has now been obtained to make an extension, and this is in course of building. Their subsidiary, Nettle Accessories, Ltd., has done well and has developed some new products during the year. The parent company has developed new television aerial equipment which is in big demand.

Berry's Electric, Ltd., report a trading profit for the year ended 31st March last of £85,532, as compared with £113,497 for the preceding year, to which is added other income making £86,694. After providing for depreciation and other charges there is a net balance of £57,649, which with £11,428 brought in, makes £69,077 available. Taxation absorbs £30,921, and the balance of £38,156 is carried forward. The directors state that they have decided not to recommend a dividend, notwithstanding the fact that one would have been justified by the results. This decision has been necessitated by the importance of conserving the company's liquid resources, which are already overstrained as a result of high taxation.

Vent-Axia, Ltd., has declared an interim dividend of 25 per cent (unchanged).

George Kent, Ltd., has declared an interim dividend of 3 per cent (unchanged).

The Rangoon Electric Tramway & Supply Co., Ltd., is paying two years' dividend on the £250,000 6 per cent preference shares, free of Burma tax, to 31st December next.

New Companies

W. R. Roberts (Electrical Contractors), Ltd.—Registered 18th November. Capital £1,000. Installers of electrical wiring, factors, fitters, maintainers, repairers, merchants and dealers in radio, television and electrical apparatus, etc. Directors: W. R. Roberts and Mrs. E. Roberts. Secretary: Mary Winn. Regd. office: 56, Whitechapel, Liverpool, 1.

Claytat, Ltd.—Registered 22nd November. Capital £30,000. Objects: To enter into an agreement between Taylor & Wilson, Ltd., of the one part and Electrical Apparatus Co., Ltd. (the promoters of this company), of the other part, and to carry on the business of iron, brass and sundry metal founders and pattern makers, general mechanical, motor and electrical engineers, etc. Directors: R. H.

Barbour, J. R. Walton and D. R. Barbour (all directors of Process Control Gear, Ltd., etc.). Regd. office : New Barnes Avenue, St. Albans.

Edstone (Electrical), Ltd.—Registered 19th November. Capital £1,000. Manufacturers, distributors, importers, exporters and dealers in radio and television receivers, etc. Directors : G. A. Upton and Hilda M. Upton. Secretary : W. J. Greenwood. Regd. office : 15, Buckingham Palace Gardens, S.W.1.

Mike Lee, Ltd.—Registered 24th November. Capital £5,000. Electrical engineers, electrical wiring and installation contractors, dealers in radio apparatus, etc. Directors : S. J. Lee and S. H. Robbins. Regd. office : 54, Regent Street, Rugby.

Harrow Electric Co., Ltd.—Registered 21st November. Capital £2,000. Manufacturers of, dealers in and repairers and hirers out of electric cables, electrical insulating materials and other electrical and mechanical apparatus and accessories, in particular radio sets and valves, television sets, etc. Directors : J. O. Parkinson, Mrs. Jane Parkinson and Mrs. Margaret M. Fletcher. Regd. office : 2, The Lawns, Hatch End, Middx.

Pick & Banham, Ltd.—Registered 19th November. Capital £100. Electric lighting, heating, refrigerating, wireless, mechanical and general engineers, etc. Directors : F. Pick and G. W. Banham. Secretary : Geoffrey W. Banham. Regd. office : 16, Friars Street, Kings Lynn, Norfolk.

Increases of Capital

Splendor Lamp Co., Ltd.—Increased by £50,000, in £1 ordinary shares, beyond the registered capital of £25,000.

Switchgear & Cowans, Ltd.—Increased by £100,000, in 5s unclassified shares, beyond the registered capital of £150,000.

Standard Telephones & Cables, Ltd.—Increased by £500,000, in £1 ordinary shares, beyond the registered capital of £5,000,000. At 6th November, 1952, the International Standard Electric Corporation, of New York, held a majority of the issued shares.

Liquidations

Atozed (London), Ltd., Vauxhall Bridge Road, London, S.W.1, electrical engineers and contractors.—Pursuant to Section 293 of the Companies Act, 1948, a meeting of creditors was held recently. According to the statement of affairs the liabilities amounted to £23,160. The assets were estimated to realize £9,953 and after allowing £932 for preferential claims, there were net assets of £9,021 leaving a deficiency of £14,139. Resolutions were passed for the appointment of Mr. D. D. Mathieson, Mathieson, King & Co., Cannon Street, London, E.C., and Mr. A. W. S. Tabbernor, Jackson, Pixley & Co., Kent House, Telegraph Street, London, E.C., as joint liquidators, together with a committee of inspection.

Clifton Electrical Services, Ltd.—Winding up voluntarily. Liquidator, Mr. H. Chambers, Rockingham House, Charles Street, Rugby, appointed 27th November.

G.B.M. (Electrical) Birmingham, Ltd.—Winding up voluntarily. Liquidator, Mr. G. J. Simmons, 16, Waterloo Road, Wolverhampton, appointed 22nd November.

Bankruptcies

G. H. Watts, carrying on business with another as Watts & Watts, at 185, Stockwell Road, Stockwell, London, S.W.9, and at 32, Moat Place, Stockwell, S.W.9, as electrical engineers.—Receiving order made 26th November on debtor's own petition.

M. Tilley, carrying on business at 13, Shakespeare Street, Newcastle-on-Tyne, as an electrical and radio wholesaler, under the style of Hawkins Tilley & Co.—Receiving order made 27th November on debtor's own petition.

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STOCKS and SHARES

FOLLOWING a good performance through most of November, the gilt-edged market in the Stock Exchange began the present month in a minor key. Among the factors making for caution were the latest Exchequer returns, showing a persistence of the abnormally wide gap existing between national revenue and expenditure. The Chancellor has recently been reassuring about the ultimate realization of his Budget estimates and objectives, but hopes of a surplus, large enough to leave room for income-tax cuts, receded perceptibly on the appearance of the latest figures. A moderate but general setback in Government stock quotations is reflected in fractional losses on the British Electricity issues, while the new 4 per cent British Transport stock went back to within 5s of the issue price of 95½. Tokyo Electric "sixes" at 184 have reacted a few points from the recent top price.

New Issues

The new Pye 5s deferred shares, offered to shareholders at 12s, have been changing hands at a premium of about 3s 6d on that figure. The old shares, at 14s 6d, are quoted ex-rights to this offer, and also to the free bonus issue of shares. Assuming the maintenance of the dividend at 18 per cent, there is a prospective return of 6¼ per cent on the shares. It may be noted, incidentally, that a line of the same company's 5 per cent preference shares has been on offer at 18s 3d, to yield 5½ per cent. Telephone Rentals new 5s shares stand at a premium of 2s 1½d, on the price of 6s at which they are offered to present holders. December 19th is the last day for the renunciation of allotment letters in respect of Switchgear & Cowan's new 5s shares, which were issued at 10s and are now quoted, fully-paid, at 14s 9d.

International Combustion Bonus

International Combustion (Holdings) has convened a meeting for the 19th of this month to authorize the proposal for a 100 per cent capital bonus, which will help to bring the present nominal amount of £880,000 ordinary capital into closer relationship with the assets of the business. A free share bonus of 150 per cent was distributed only three years ago. Dividends were increased moderately in the two succeeding years, and the interim dividend for the current twelve months was raised from 7½ to 10 per cent, but with the proviso that this did not necessarily imply a larger total. Last year's earnings were equivalent to 115 per cent on the present issued capital, on which 25 per cent was paid. Recently the company announced the issue of 320,000 shares in connection with the acquisition of an undertaking of value to the organization in facilitating the production of plant and equipment for electric power stations, and in other ways.

Capital and Consumer Goods

In the market for electrical equipment shares, as in other industrial sections, quotations reflect an increasing tendency for the investor to differentiate in favour of investments connected with the production of machinery and other forms of capital equipment, as opposed to goods intended for sale to the public and coming in what the economists call the "consumer" category. There are marked differences in the yields obtainable at present from shares which can be distinguished as belonging to one category or the other.

Low Priced Shares

The list of a Stock Exchange market firm specializing in low-priced engineering and electrical shares includes, among the shares currently on offer in fair numbers, Dubilier Condenser 1s ordinary at 3s, yielding 6⅔ per cent on the dividend of 20 per cent. The distribution was shown in the last accounts to be covered by earnings equivalent to nearly 140 per cent on the ordinary capital. A similar yield is obtainable from Aeronautical & General Instruments 5s shares at 3s 9d. Engineering & Lighting 2s shares can be bought at just over par, to yield about 9¾ per cent. In both cases the dividends are covered five or six times on the basis of the latest published profits. Lindley Thompson 1s ordinary are offered at 1s 1d, at which they give a prospective return of 11½ per cent.

Yields of 8 per cent

The 2s shares of Dictograph Telephones (due to hold the annual meeting this week) are quoted at about 5s to yield 8 per cent on the basis of the 20 per cent dividend paid for the year ended last August. Group net profits of the year, after increased taxation, showed another advance to £59,000, of which about half is being distributed in the preference and ordinary dividends. The latter have been at the present rate for the last four years, during which time the trading profits have been expanded by nearly 40 per cent. In his review accompanying the accounts, the chairman drew attention to a strengthening of the group's liquidity, and wrote confidently of the further prospects. The Burco company, which also held its annual meeting this week, reported increased profits for 1951-52, but moderately reduced the ordinary dividend to 35 per cent for the further improvement of a strong financial position. The 5s shares at 19s 6d give a yield of 8·9 per cent.

ELECTRICAL INVESTMENTS

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price 8th Dec. 1952	Week's Rise or Fall	Est. Yield p.c.
Gilt-edged and Overseas Stocks			£ s		d
Brit. Elec. 1968/73	3	3	84½	−½	3 11 0
Brit. Elec. 1974/77	3	3	83⅓	—	3 11 10
Brit. Elec. 1976/79	3½	3½	89⅓	—	3 18 3
Brit. Elec. 1974/79	—	4½	100	—	4 5 8
Calcutta Elec. ..	6†	6†	20/-	—	6 0 0†
East African Power	7	7	22/-	—	6 7 3
Nigerian Elec. ..	10	10	21 3	—	—
Palestine Elec. "A"	5†	Nil	11/-	—	—
Perak Hydro-Elec.	Nil	Nil	14/-	—	Nil
Equipment and Manufacturing					
AberdareCables(5/-)	20	20	14/6	—	6 18 0
Aerialite (1/-) ..	83½	88½	8/6	+3d	10 7 9
Allen, W. H. ..	15	15	41/9	—	—
Aron Elec. Ord. ..	15	15	33/9	—	8 17 9
Assoc. Elec. Ord...	20	20	75/-	—	5 6 8
Automatic Tel.& El.	15	15	58/9	+ 1/8	5 2 3
Babcock & Wilcox	18	18	70 3	−9d	5 2 6
Baldwin, H. J.(2/-)	25	20	3/6	—	11 8 9
Bakelite (10/-) ..	—	—	16 3	−9d	—
British Aluminium	10	12	43/9	—	5 9 7
B.I. Callender's ..	7½	9	33/-	—	5 9 1
British Thermostat (5/-)	30	30	27/-	—	5 11 1
British Vac.Cleaner (5/-)	25	25	13/6	+6d	9 5 2
Brook Motors(10/-)	20	20	30/3	+2/-	6 12 3
Brush Ord. (5/-) ..	10	10	5/-	—	10 0 0
A. F. Bulzin (1/-)..	27½	30	2/7½	—	11 8 6
Burco (5/-) ..	38¾	35	19/6	—	8 18 0
Chloride El. Storage	15	15	61/3	—	4 18 0
Cole, E. K. (5/-) ..	25	25*	17/-	—	7 7 1
Cossor, A. C. (5/-)	Nil	10	10/-	—	5 0 0
Crabtree (10/-) ..	17½	17½	31/3	—	5 12 0
Crompton Parkinson Ord. (5/-) ..	11¼	11¼	9/-	—	6 5 0
De La Rue (5/-) ..	50	35*	7/6	−9d	—
Decca (1/-) ..	112½	112½	18/-	−1/-	6 5 0
Dewhurst (2/-) ..	22½	19*	5/-	—	5 12 0
Dictograph Tel.(2/-)	20	20	5/-	—	8 0 0
E.M.I. (10/-) ..	12	12	14/6	−6d	8 5 6
Electrical Components (5/-) ..	20	20	10/-	—	10 0 0
Elec. Construction	15	15	50/-	—	6 0 0
Enfield Cable Ord.	7½	7½	22/-	+6d	6 16 4
English Electric ..	15	15	59/-	+3/6	5 1 8
Ericsson Tel. (5/-)	22†	22*†	40/6	+1/6	2 14 6†
Ever Ready (5/-)	35	35	26/-	—	6 14 8
Falk Stadelmann	15	15	38/9	—	7 14 8
G.E.C. Ord. ..	22½	22½	42/6	—	5 6 0*
General Cables (5/-)	30	30	14/6	—	10 6 10
Greenwood & Batley	15	15	38/-	—	7 18 0
Hackbridge Cable (5/-)	20	20	10/3	—	9 15 0
Hackbridge Hewittic (5/-)	18	20	16/3	—	6 3 0
Hall Tel. Acc. (10/-)	10	10	10/-	−6d	10 0 0
Heatrae (2/-) ..	12½	12½	4/-	—	6 5 0
Henleys (5/-) ..	20	20	18/3	−3d	5 9 6
Holophane (5/-) ..	15	20*	11/3	—	8 17 10
Hoover (5/-) ..	37½	35*	23/3	−6d	7 10 6

Company	Dividend Previous	Dividend Last	Middle Price 8th Dec. 1952	Week's Rise or Fall	Est. Yield p.c.
Equipment and Manufacturing (continued)			£ s		d
Intl. Combustion (5/-)	20	25	24/6	—	5 2 1
Johnson & Phillips	15	15	52/-	—	5 15 5
Lancashire Dynamo	22½	12½*	42/6	—	5 17 8
Laurence,Scott(5/-)	12½	15	13/3	—	5 13 3
London Elec. Wire	12½	12½	51/3	—	4 17 6
J. Lucas	7½	9½	36/3	—	5 1 3
Marryat & S. (2/-)	22½	22½	5/-	—	9 0 0
Mather & Platt ..	12½	12½	42/-	−6d	5 19 0
Metal Industries ..	10	15	41/3	—	7 5 8
Mid. Elec. Mfg. ..	15	15	55/-	+ 1/8	5 9 1
Murex	12½	15	55/-xr	—	5 9 0
Newman Ind. (2/-)	6	10	2/3	—	8 17 10
Oldham & Son (1/-)	30	35	2/6	—	—
Parnall (Yate) (5/-)	6	6	4/-	—	7 10 0
Parsons, C. A. ..	15	10*	55/-	+ 1/8	—
Plessey (5/-) ..	22½	25	21/3	+1/6	5 17 9
Pye Deferred (5/-)	18	18	14/6xr	− 1/8	—
Revo (10/-) ..	27½	27½	42/6	—	6 9 6
Reyrolle	15	10*	50/9	+2/-	—
Scot. Cable (4/-) ..	30	32	11/3	—	—
Siemens Ord. ..	10	10	34/6	+6d	5 16 0
Strand Elec. (5/-)	17½	17½	8/9	—	10 0 0
Sturtevant (5/-) ..	16¾†	17¾*†	22/6	—	—
Switchgear&Cowans (5/-)	22½	22½	15/-	—	7 10 0
Taylor T. (5/-) ..	20	20	19/3	—	5 4 0
T.C.C. (10/-) ..	20	20*	38/-	+6d	—
T.C. & M... ..	10	10	26/-	+6d	—
TelephoneMfg.(5/-)	10	10	8/-	—	—
Thorn Elec. (5/-)..	10	12½	8/-	—	7 10 3
Tube Investments	25	15*	60/-	+ 1/8	5 0 0
Vactric (5/-) ..	Nil	Nil	4/6	−6d	Nil
Veritys (5/-) ..	Nil	7½	4/9	—	7 18 0
Walsall Conduits (4/-)	70	70	46/-	—	—
Ward & Goldstone (5/-)	45	45*	30/9	—	—
Watford (2/-) ..	25	25	6/3	—	8 0 0
Westinghouse Brake	14	14	50/-	—	5 12 0
West, Allen (5/-) ..	12½	15	10/3	—	7 6 4
Trusts, Transport and Communications					
Anglo-Am. Tel.: A Ord.	—	6	79½	—	7 11 0
Ord.	—	3¾	55	—	6 16 3
Anglo-Portuguese	8	8	20/6	—	7 16 1
Brit.Elec.Traction: Def. Ord. ..	22½	25	425	—	5 17 8
Cable & Wireless: Ord.	6	8	123½	—	6 9 7
4% Loan ..	4	4	96	−2½	4 3 4
Calcutta Trams ..	6†	6†	22/-	+1/-	5 9 1†
Cape Elec. Trams	5	5½	10/-	—	11 0 0
Marconi Marine ..	10	10	30/6	—	6 11 3
Oriental Tel. Ord.	16	16	58/6	+1/-	—
Telephone Props.	8	8	35/-	—	4 11 5
Tele. Rentals (5/-)	10	10	8/-xr	—	6 5 0

* After capital bonus.

† Dividends are paid free of Income Tax.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

"Zebra" Crossing Flashers

THE a.c. operated flasher unit for "zebra" crossings which is made by ENGEL & GIBBS, LTD., Warwick Road, Boreham Wood, Herts, is fitted with a 15 A mercury switch and is normally supplied totally enclosed with only a synchronizing adjustment knob protruding.

A "zebra" flasher has recently been put on the market by the HORSTMANN GEAR CO., LTD., Newbridge Works, Bath, and its price to municipal authorities is £4 net.

LONDEX, LTD., Anerley Works, 207, Anerley Road, London, S.E.20, has introduced a plug-in type flasher unit which incorporates a mercury switch.

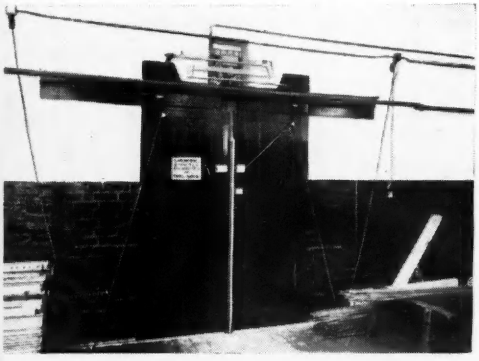
The flasher unit made by VENNER, LTD., Kingston By-pass, New Malden, Surrey, is available in either of two boxes, one of light alloy for mounting on top of existing poles and the other of cast iron for strapping to the pole base.

Automatic Sliding Doors

Doors developed primarily for lift entrances by the EXPRESS LIFT CO., LTD., Abbey Works, Northampton, have been adapted for use in factories and warehouses. Because these doors close automatically they prevent draught and facilitate the maintenance of a constant temperature within the shop. The doors consist of two sliding panels opening from the centre and run on ball bearing rollers on bright steel tracks. They are opened and closed by an electrical operator which, in order to prevent excess torque being transmitted to them, incorporates a clutch.

A sensitive edge is fitted to the doors to ensure their instant reversal should an obstruction be encountered. An adjustable time delay is embodied in the controller so that the doors are held open for any predetermined period within the limits allowed. The doors are opened by means of press buttons which can be fitted at any convenient point.

Express automatic sliding doors for factories and warehouses



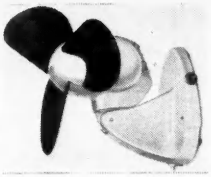
Self-Bonding Insulating Tape

A self-sealing insulating tape which was originally designed for the manufacture of submarine cable joints is now being made under the trade name "Telcohesive" by the TELEGRAPH CONSTRUCTION & MAINTENANCE CO., LTD., Telcon Works, London, S.E.10. This tape, which will withstand underwater pressures of up to 4 tons/sq in without breakdown of the adhesion and has excellent ageing properties, is supplied in 10 yd reels 1in wide. A backing tape is wound in the reel to prevent self-adhesion and this detaches itself from the adhesive during taping. The tape is translucent and extensible and is used merely by wrapping it round the materials to be jointed while maintaining tension and ensuring a slight overlap between turns. It can be used for making watertight joints between all known cable insulations, and also between lead-sheathed cables and those sheathed with thermoplastics or v.i.r.

Oscillating Rubber-Bladed Fan

A 10in rubber-bladed oscillating table and bracket fan which gives an air displacement of 900 cu ft/min with a peak velocity of 770 ft/min is now being made by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. Of die-cast construction, it follows the general lines of the company's 8in fan. The oscillating mechanism is robust yet compact and is contained within the motor body, there being no exposed cranks or levers. A patented slipping clutch is incorporated to safeguard the mechanism and the motor in the event of the arc of oscillation being obstructed. This enables any 90 deg arc to be selected out of the 180 deg

available. It is only necessary to "focus" the air stream by turning the motor body, when the oscillation will automatically continue about the selected point. The fan employs a totally enclosed shaded-pole induction motor and is available for use on a wide range of a.c. mains voltages, the rating being 30 W. The fan weighs 5·5 lb and is priced at £7 18s plus £3 19s purchase tax.



G.E.C. 10in rubber-bladed oscillating table and bracket fan

Magnetic Crack Detector

The range of magnetic crack detection equipment made by the MAGNETIC EQUIPMENT CO., LTD., Lake Works, Portchester, Hants, has been supplemented by the provision of a universal machine for dealing with the most complicated castings and shafts up to 5ft long, or longer to special order. The machines are available in two types, MCC for current flow testing and MCD for current flow and magnetizing tests. It comprises two sliding heads capable of opening from 2in to 5ft or more and for repetition work one head can be clamped and moved and held by an air operated pressure cylinder. Control of the air cylinder and magnetizing is by foot switches enabling the operator to handle the work with both hands.

The inspection of large castings frequently requires the work to be laid on a tray and solenoids formed by wrapping a few turns of heavy flexible cable around different parts of the casting in turn. To facilitate this the machine is furnished with rear terminals and a heavy current change-over switch so that false readings cannot be obtained should the heads or cables be accidentally short circuited by other work; provision has also been made for plugging in magnetic leeches for speedy operation in current flow testing of work adjacent to the machine. The company is also making a range of demagnetizers with apertures ranging from 3in to 30in.

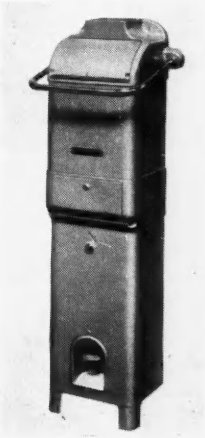
Automatic Sanitary Incinerator

Effective smoke suppression by means of an induced draught is a feature of the automatic sanitary incinerator just brought out by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. To ensure continuity of operation a spare element is fitted below the pedestal cover of each unit.

The body of the incinerator is of cast aluminium fixed to steel angles and enclosed by sheet steel. The ash pan is a steel pressing and the element platform is an electrical and heat resisting block, the element being a solid nickel-chrome rod. The heat insulated ash disposal door has a coin operated catch and is hinged from the bottom.

The incinerator is operated by a foot pedal which opens the charging door and starts the time switch. Two types of flue adaptor enable the flue to rise either vertically or be taken back through the wall, to which the unit can be bolted if so desired. Below the incinerator cover are the main and sub-fuses and a conduit entry is provided at the base. An indicator lamp glows when the main switch is closed and gives a bright red light when the element is in operation. Rapid in operation, this incinerator will cater for about 50 to 100 people. It is finished in light green polychromatic heat resistant paint and will operate on 100 250 V a.c. mains. It is guaranteed for 12 months.

Magnetic crack detector and demagnetizer by the Magnetic Equipment Co., Ltd. and *(right)* **G.E.C. automatic sanitary incinerator**



NEXT WEEK'S EVENTS

Monday, 15th December

BIRMINGHAM.—Midlands Hotel. Birmingham Electric Club. Brains Trust.

BOURNEMOUTH.—Grand Hotel, Firvale Road, 8.15 p.m. A.S.E.E. Bournemouth Branch. Lecturettes by members.

GLASGOW.—39, Elmbank Crescent, 7.15 p.m. Institution of Works Managers, Glasgow Branch. "Human Relations in Modern Industry," by Dr. T. T. Paterson.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio Section. Discussion on "How to Plan a Radio Project," opened by Dr. J. Thomson.

NORTHAMPTON.—Institution of Works Managers, Northampton Branch. Annual dinner.

Tuesday, 16th December

CARDIFF.—South Wales Electricity Board demonstration theatre, 5.45 p.m. I.E.S. Cardiff Centre. "Floodlighting," by R. O. Ackerley.

DUMFRIES.—Ewart Library, 7.30 p.m. Dumfries and Galloway Electrical Society. "Overhead Lines," by N. G. Simpson.

GLASGOW.—39, Elmbank Crescent, 7 p.m. I.E.E. South-West Scotland Sub-Centre. "Microwave Radio Links," by Dr. A. T. Starr and T. H. Walker.

GLOUCESTER.—New County Hotel. Institution of Heating and Ventilating Engineers, South Western Branch. Annual dinner.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midlands Students' Section. Problems evening.

LIVERPOOL.—Merseyside and N. Wales E.B., Whitechapel, 6 p.m. I.E.S. Liverpool Centre. "The Eye, Brightness and Illuminating Engineering," by W. S. Stiles.

LONDON.—Savoy Place, W.C.2, 7 p.m. I.E.E. London Students' Section. "Modern Transformer Construction," by A. J. W. Beckey.

2, Savoy Hill, W.C.2, 6.30 p.m. Association of Supervising Electrical Engineers. "Progress in Electric Lighting," by W. J. Jones.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute, Corporation Road, 6.30 p.m. I.E.E. Tees-Side Sub-Centre Students' Section. "Electrical and other Means of Ship Propulsion," by R. A. Hore.

Wednesday, 17th December

BIRMINGHAM.—Midland Institute, 6.30 p.m. I.E.E. South Midland Centre. "Factors Affecting the Location, Design and Operation of a Modern Coal-Fired Power Station," by F. W. Lawton. (Joint meeting with the I.C.E. and I.Mech.E.)

Imperial Hotel, 6.30 p.m. Institution of Heating and Ventilating Engineers, Birmingham and District Branch. "Thermostatic Controls," by L. B. Rothwell.

COVENTRY.—Technical College, 7.15 p.m. A.S.E.E. Coventry Branch. "Some Electro-Mechanical Equipment for Machine Tools," by C. Haywood.

EDINBURGH.—Heriot-Watt College, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "Microwave Radio Links," by Dr. A. T. Starr and T. H. Walker.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. "Uses of Earthed Signal Conductors on Transmission Circuits," by W. Casson.

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. A.S.E.E. Manchester Branch. Chairman's night.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institution, Corporation Road, 6.30 p.m. I.E.S. Tees-Side Group. "Brightness Engineering," by W. Robinson.

PRESTON.—49a, Fishersgate, 7.15 p.m. I.E.S. North Lancashire Group. "Lighting of Architecture," by G. Grenfell Baines.

ROCHESTER.—Bull Hotel, 7 p.m. Incorporated Plant Engineers, Kent Branch. "Planned Maintenance for the Plant Engineer," by F. L. Griffiths.

SHEFFIELD.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. "Economic Plant Sizes and Boiler-Set Groupings on the British Grid," by B. Donkin and P. H. Margen. (Joint meeting with the Institution of Mechanical Engineers.)

SWANSEA.—Minor Hall, Y.M.C.A., 6 p.m. I.E.S. Swansea Group. "Floodlighting," by R. O. Ackerley.

WIMBLEDON.—The Guild House, 32, Worple Road, 8.15 p.m. A.S.E.E. South-West London Branch. "Responsibility of a Supervisor," by W. J. Spencer.

Thursday, 18th December

BRISTOL.—Mauretania Bar, Park Street, 7.15 p.m. E.P.E.A. South Western Technical Group. "Any Questions?" with panel of experts of the S.W. Board and Division.

CHELTENHAM.—Cadena Café, High Street, 6.15 p.m. I.E.S. Gloucester and Cheltenham Centre. "The Equipment and Functions of an Illumination Laboratory," by H. F. Stephenson.

DUBLIN.—Trinity College, 6 p.m. I.E.E. Irish Branch. "275 kV Developments on the British Grid System," by D. P. Sayers, Dr. J. S. Forrest and F. J. Lane.

EXETER.—Imperial Hotel. Exeter Electric Club. "Reminiscences by a former H.M. Electrical Inspector of Mines and Quarries," by W. R. Robinson.

GLASGOW.—Engineering Centre, 7 p.m. British Institution of Radio Engineers, Scottish Section. "Demonstration of latest Electronic Devices," by W. O. Buchanan.

LONDON.—Caxton Hall, Westminster, 2.30 p.m. Diesel Engine Users' Association. "Report on Heavy Oil Engine Working Costs, 1950–51."

LUTON.—George Hotel, 8 p.m. A.S.E.E. Luton Branch. "Diesel Electric Generation."

NOTTINGHAM.—Gas Showrooms, Parliament Street, 6.30 p.m. Institution of Heating and Ventilating Engineers, East Midlands Branch. "Plant Control through Instruments," by J. E. O. Breen and Mr. Leonard. (Joint meeting with the East Midlands Section, Institute of Fuel.)

SOUTHAMPTON.—Polygon Hotel, 7 p.m. I.E.E. Southern Centre. Annual dinner and dance.

Friday, 19th December

GLASGOW.—Royal Technical College, George Street, 7 p.m. Society of Instrument Technology, Scottish Section. "Navigational Instruments," by W. B. Leckie.

LIVERPOOL.—Exchange Hotel, Tithebarn Street. Institution of Heating and Ventilating Engineers, Liverpool and District Branch. Ladies' evening.

Saturday, 20th December

EXETER.—Wrentham Hall. Exeter Electric Club. Children's party.

Transport Conference

THE 1953 Conference of the Public Transport Association will be held from 21st to 23rd April next at Folkestone. The conference headquarters will be at the Grand Hotel, and the programme will include the Maynard Cup golf competition, the annual general meeting, a civic reception, and a dance. Two papers will be presented and discussed during the conference.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 21st January, from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1948

16627. Mullard Radio Valve Co., Ltd., and Kelliher, M. G.—Stroboscopes. 21st July, 1949. (686092.)

32914. Radio Corporation of America.—Image pick-up tube. 20th December, 1948. (686093.)

1949

9576. Neale & Sons, Ltd., J., and Neale, M. R.—Electric lamps for road vehicles. 11th April, 1950. (686379.)

9591. Standard Telephones & Cables, Ltd.—System for establishing telephone connections or the like in networks which may extend over several territories. 8th April, 1949. (686165.)

11433. Currie, D., and Summersgill, J. F.—Illuminated signs. 5th May, 1950. (686306.)

15632. Hoover (Electric Motors), Ltd., and Hands, C. H.—Varnishing of stators for dynamo-electric machines. 6th June, 1950. (686308.)

16414. Electric & Musical Industries, Ltd.—Manufacture of cathode-ray tubes. 20th June, 1950. (686096.)

22002. Chamberlain & Hookham, Ltd., and Deacon, L. O.—Electrical impulse indicating or recording systems. 15th November, 1950. (686386.)

22246. Böhler & Co. Akt-Ges., Geb.—Electrodes for underwater cutting and welding. 30th September, 1949. (686106.)

27302. Thessco Industrial Research, Ltd., and Briggs, J. C.—Electrical contacts. 20th October, 1950. (686108.)

28243. Electric & Musical Industries, Ltd.—Television transmitting apparatus. 6th November, 1950. (686313.)

28383. Seismograph Service Corporation.—Radiolocation system. 5th November, 1949. (686389.)

29344. British Thomson-Houston Co., Ltd.—Electric discharge devices. 16th November, 1949. (686109.)

31020. Standard Telephones & Cables, Ltd., Hough, G. H., and Jackson, T. M.—Electric discharge devices. 2nd December, 1949. (686317.)

31315. Loftheim, T. B.—Apparatus for removing dust and other impurities from air, funnel smoke and other gases especially gases from chemical and electro-chemical factories. 6th December, 1949. (686318.)

32784. Thorn Electrical Industries, Ltd., Kember, R. C., and Anderson, L. T.—Fluorescent lighting fittings. 21st December, 1950. (686392.)

1950

2640. Hoover (Washing Machines), Ltd.—Washing machines for clothes and the like. 1st February, 1950. (686397.)

5758. Belling & Lee, Ltd.—Manufacture of small shielded electrical components. 5th March, 1951. (686118.)

7038. Du Mont Laboratories, Inc., A. B.—Tuning device for high-frequency electrical energy. 21st March, 1950. (686323.)

8091. Automatic Telephone & Electric Co., Ltd.—Electric ribbon cable. 19th March, 1951. (686186.)

8528. Ericsson Telephones, Ltd., and Wilman, C. V.—Self-interrupted drive circuits for electromagnetically operated devices. 21st March, 1951. (686187.)

9399. British Insulated Callender's Cables, Ltd.—Manufacture of electric cables. 17th April, 1951. (686408.)

12322. British Thomson-Houston Co., Ltd.—Powder coatings and processes of manufacture of the same. 17th May, 1950. (686259.)

13359. General Electric Co., Ltd., and Biggs, A. J.—Apparatus for use with cathode-ray tubes. 28th May, 1951. (686327.)

13403. Santon Developments, Ltd.—Electrically heated liquid pans. 29th May, 1951. (685863.)

14090. Philips Electrical Industries, Ltd.—Demodulators for frequency-modulated oscillations. 6th June, 1950. (686034.)

14138. General Electric Co., Ltd., Foxon, H. J., and Sowter, A. B.—Pressure welding of overlapping edges of sheet metal. 29th May, 1951. (686126.)

14444. Philips Electrical Industries, Ltd.—Circuits for use in automatic telephone exchange and like systems. 9th June, 1950. (686075.)

14446. Philips Electrical Industries, Ltd.—Circuit arrangements for use in automatic signalling systems. 9th June, 1950. (686128.)

15079. Board of Trustees of Leland Stanford Junior University.—Oscillators employing travelling-wave tubes. 16th June, 1950. (685787.)

16542. British Thomson-Houston Co., Ltd.—Reflection reducing coatings. 3rd July, 1950. (686132.)

18142. Stephen, R. A.—Treatment of polystyrene for use in electroscopes. 18th October, 1951. (686337.)

19016. Licentia Patent-Verwaltungs-Ges. — Housing protected against fire-damp, particularly for electric switches and like apparatus. 31st July, 1950. (685792.)

20138. British Thomson-Houston Co., Ltd.—Magnetic cores. 14th August, 1950. (686040.)

23861. Philips Electrical Industries, Ltd.—Deflecting coils for cathode-ray tubes. 29th September, 1950. (686270.)

23873. Westinghouse Electric International Co.—Gas turbine power plants. 29th September, 1950. (686425.)

24072. Siemens & Halske Akt.-Ges.—Circuit arrangement for automatic frequency adjustment in receiving installations for frequency-keyed telegraphy transmitters. 2nd October, 1950. (685798.)

24389. General Electric Co., Ltd., and Hill, R. T. J.—Cathode-ray tubes. 19th July, 1951. (686345.)

24603. British Thomson-Houston Co., Ltd.—Reflection reducing coatings. 9th October, 1950. (686199.)

24710. Telefonaktiebolaget L. M. Ericsson.—Balancing machines. 10th October, 1950. (686272.)

26128. Opperman, E. G.—Electric ironing machines. 10th October, 1951. (686200.)

26137. Soc. Genevoise d'Instruments de Physique.—Reading arrangement for photoelectric microscopes. 26th October, 1950. (686274.)

27107. Hughes & Co., Ltd., F. A.—Electrical testing devices. 26th November, 1951. (686051.)

27213. De Havilland Aircraft Co., Ltd., and Jackson, C. C.—Conduits for electric cables. 30th October, 1951. (685964.)

27336. Tesla National Corporation, and Vana, J.—Electron tubes. 8th November, 1950. (685800.)

27765. Burco, Ltd., and Westall, F.—Hot water systems. 24th October, 1951. (685887.)

28308. British Thomson-Houston Co., Ltd.—Methods and apparatus for measuring the concentration of condensation nuclei. 20th November, 1950. (685965.)

31145. Landis & Gyr Akt.-Ges.—Electrical measuring instruments. 21st December, 1950. (686056.)

31423. Kobler, V., and Kobler, W. (trading as Kobler & Co.).—Power-operated dry-shavers. 27th December, 1950. (685804.)

26585. Brown, Boveri & Cie. Akt.-Ges.—Arrangements for supplying separately excited reversible motors from current convertors. 31st October, 1950. (686202.)

27679. British Thomson-Houston Co., Ltd.—Clutch brakes, particularly for use with electric motors. 13th November, 1950. (686141.)

27741. Avery, Ltd., W. & T. (C. Schenck Maschinenfabrik Ges.).—Means of dynamically balancing rotors. 14th November, 1950. (686205.)

27883. Nield, D.—Electric insulators. 1st November, 1951. (686348.)

29065. Etablissements Merlin & Gerin.—High-voltage electric circuit interruptors. 28th November, 1950. (686207.)

29295. Dereux, J. A.—Electrical musical instruments. 29th November, 1950. (686276.)

30648. Western Electric Co., Inc.—Gaseous discharge devices, particularly of the cold-cathode type. 15th December, 1950. (686427.)

1951

4. Libbey-Owens-Ford Glass Co.—Electrode connections to conducting films on vitreous surfaces. 1st January, 1951. (686280.)

1750. Constructions Electromécaniques de St.-Etienne, Ancienne Usine Wageor.—Machine for tubing and detubing multi-tubular boilers. 23rd January, 1951. (686281.)

2799. British Thomson-Houston Co., Ltd.—Electric paint burners. 5th February, 1951. (686283.)

3816. Standard Telephones & Cables, Ltd.—Phase-changer. 16th February, 1951. (686286.)

4227. British Thomson-Houston Co., Ltd.—Electric motor control systems. 21st February, 1951. (686355.)

7952. United-Carr Fastener Corporation.—Electric lamp sockets. 5th April, 1951. (686290.)

10082. British Thomson-Houston Co., Ltd.—Combined electrode and skimmer for electric glass melting furnaces. 30th April, 1951. (686220.)

11016. Singer Manufacturing Co.—Electric motor with clutch-brake device. 10th May, 1951. (686149.)

12274. Bosch Ges., R.—Self-sealing condensers. 25th May, 1951. (686293.)

12536. Ericsson Telephones, Ltd., and Drysdale, L. H.—Automatic telephone systems. 29th May, 1951. (686437.)

12789. Siemens-Schuckertwerke Akt.-Ges.—Multiple pole automatic electric switches with magnetic and thermal tripping members. 30th May, 1951. (686222.)

14038. Radio-Industrie Soc. Anon.—Apparatus for encoding electric signals. 13th June, 1951. (686439.)

15216. Koninklijke Machinefabriek Geb. Stork & Co., N. V.—Control of electric motors driving mine ventilator devices. 27th June, 1951. (686225.)

16081. Philips Electrical Industries, Ltd.—Negative temperature coefficient resistors. 6th July, 1951. (686155.)

16823. British Thomson-Houston Co., Ltd.—Electric lampholders. 16th July, 1951. (686368.)

17715. Hawke, W.—Clamping gland for armoured electric cable. 26th July, 1951. Addition to 666004. (686299.)

18379. Dynamatic Corporation.—Eddy-current drum construction for electrical machines. 3rd August, 1951. (686158.)

20357. Allmanna Svenska Elektriska Aktiebolag.—Overload release and restoring device for automatic electric circuit breakers. 29th August, 1951. (686227.)

21982. British Thomson-Houston Co., Ltd.—Closure fasteners. 19th September, 1951. (686229.)

22582. Short Bros. & Harland, Ltd.—Electronic selector switch. 27th September, 1951. (686369.)

25543 & 26516. Crabtree & Co., Ltd., J. A.—Handle-operated electric motor starting switches. 3rd October, 1950. (Divided out of 686688.) (686739 & 686741.)

25544. Crabtree & Co., Ltd., J. A.—Overload release elements for electric switches. 3rd October, 1950. (Divided out of 686688.) (686740.)

27087. British Thomson-Houston Co., Ltd.—Electrical defrosting arrangements for refrigerators. 19th November, 1951. (686230.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates stated :—

19th December

SIGFLARE. No. 707,722. Class 9. Switches for use in connection with directional signal indicating lamps for vehicles.—Signal-Stat Corporation, Brooklyn, New York, U.S.A. Address for service, c/o C. Lockett Hughes, 46, Bedford Row, London, W.C.1.

SCALAMP. No. 708,216. Class 9. Galvanometers.—W. G. Pye & Co., Ltd., "Granta" Works, Newmarket Road, Cambridge.

NUFAX. No. 709,896. Class 9. Transmitting and recording apparatus for telegraphic, telephonic, telephotographic and wireless telegraphic purposes.—Muirhead & Co., Ltd., Croydon Road, Elmers End, Beckenham, Kent.

QUALITON. No. 699,361. Class 11. Lamps and installations, all for lighting; installations and apparatus included in Class 11, all for heating and cooking; and ventilators and disinfecting apparatus.—Elektromper Villamossagi es Finommechanikai Kulkereskedelmi Vallalat, Budapest, Hungary. Address for service, c/o W. P. Thompson & Co., 12, Church Street, Liverpool, 1.

PRISMALUX. No. 704,152. Class 11. Electric light fittings.—Wardle Engineering Co., Ltd., Elsinore Road, Old Trafford, Manchester, 16.

26th December

B.I. CALLENDER'S (design). No. 707,321. Class 7. Electric welding machines and electric vulcanizing apparatus for use in repairing electric cables. No. 709,537. Class 9. Parts and fittings for electrical instruments and apparatus and material for electrical purposes, all in the form of rods, strips, bars and sections; electric resistance material in the form of metal wire, metal braid and metal strands; electric resistances, fuse wire, fuses, electrodes for electric welding apparatus, electrical connectors, apparatus for locating faults in electric cables, wave guides (electrical apparatus) and electric current collecting devices for traction systems.—British Insulated Callender's Cables, Ltd., Norfolk House, Norfolk Street, London, W.C.2.

TERROSCOPE. No. B707,234. Class 9. Electronic apparatus for locating subterranean metal objects; and units comprising electronic apparatus, microphones and meters for locating defects in subterranean pipes.—Gertrud Bächler-Wyss, Berne, Switzerland. Address for service, c/o Marks & Clerk, 57 and 58, Lincoln's Inn Fields, London, W.C.2

NICRALLOY. No. B708,533. Class 9. Wire, metal strip and metal tape, all being electrically insulated material and resistance wire, electrical resistances and electrical heating elements included in Class 9; all being goods of metal alloys.—Hall & Pickles, Ltd., 64, Port Street, Manchester, 1.

CAPACAIR. No. 708,987. Class 9. Electronic apparatus controlling pneumatic pressures and operated by variations in electrical voltage, current or phase.—Fielden (Electronics), Ltd., Paston Road, Wythenshawe, Manchester.

DICTAVOICE. No. 709,952. Class 9. Sound recording and reproducing apparatus and instruments and parts included in Class 9.—Primar Electronic & Technical Products, Ltd., 435, Grand Buildings, Trafalgar Square, London, W.C.2.

PARCOM. No. B710,984. Class 9. Telephonic intercommunication apparatus.—P.A.R. Ltd., 95, Talbot Street, Nottingham.

No. 710,992 (design). Class 9. Stroboscopes, radio and television receiving sets, sound transmitting apparatus, public address apparatus, loudspeakers, sound amplifiers, microphones, sound recording apparatus, etc., and parts included in Class 9.—Argo Record Co., Ltd., 29, Gerrard Street, London, W.1.

HIRAE. No. 710,033. Class 11. Electric heating apparatus included in Class 11.—Dulrae, Ltd., 6, Broad Street Place, London, E.C.2.

GRUBLOCK. No. B710,762. Class 11. Electrical installations and parts included in Class 11, for lighting, cooking and heating.—Lockwood & Grubb Co., 9, Highgate Road, Balsall Heath, Birmingham, 12.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Alnwick.—R.D.C. Construction of about 330 yd of low voltage overhead line to a pump house at Acklington. O. M. Farrell, surveyor, 34, Green Batt, Alnwick.

Beckenham. — 31st December. Borough Council. Jobbing work (electrical trades) for the year commencing 1st April next. Borough engineer, Town Hall.

Belfast.—17th December. Northern Ireland Hospitals Authority. Repairs and additions to the electrical installation at the Ulster Hospital for Children and Women. J. R. Murland, consulting engineer, 13, Wellington Place, Belfast.

Glasgow. — 18th December. Corporation. Supply of p.v.c. conductors. (See this issue.)

India. — NEW DELHI. — 29th December. Director General of Supplies and Disposals. Supply of one 1,500 kVA transformer. (C.R.E. 40860/52. Ten/5275.)*

Leeds. — 3rd January. Corporation. Six auto-transformer starters for Knostrop sewage works. (See this issue.)

London. — FINSBURY. — 10th January. Borough Council. Electric lamps for one year from 1st April. Borough engineer, Finsbury Town Hall Annexe, Rosebery Avenue, E.C.1.

Pakistan.—KARACHI.—5th January. Director General, Department of Supply and Development. Supply of 50, 100 and 200 kW diesel generating sets. (C.R.E. 40186/52. Ten/5267.)*

Romford.—10th January. Borough Council. Electric lamps for one year commencing 1st April. Borough engineer, Town Hall.

Thurrock.—16th February. U.D.C. Three pumps including electric motors and starters for Stanford sewerage scheme. A. E. Poole, clerk, Council Offices, Grays, Essex.

Wembley.—31st December. Borough Council. Electric lamps for one year from 1st April. Borough engineer and maintenance and transport engineer.

ORDERS PLACED

London.—L.C.C. Seven 8-person lifts at Clapham Park housing estate, Clarence Avenue site (£18,284).—Waygood-Otis, Ltd.

Twelve 8-person lifts at the Ashburton estate, Chartfield Avenue site (£28,368) and eleven 4-person lifts at the Oaklands estate extension (£19,580).—Express Lift Co., Ltd.

Longbenton (Northumberland).—U.D.C. —Electrical installations in 20 houses at Wideopen.—J. G Tatton.

Manchester.—Highways Committee. Stores and materials for the year ending 31st December, 1953:—Street lighting lanterns (top entry).—General Electric Co., Ltd.; Wardle Engineering Co., Ltd.; Revo Electric Co., Ltd. Street lighting lanterns (top or side entry).—Engineering & Lighting Equipment Co., Ltd.; G.E.C. Street lighting time switches of various types.—North Midlands Engineering Co., Ltd.; Revo Electric Co., Ltd.; Horstmann Gear Co., Ltd. Cable for street lighting (various types and sizes).—Falk, Stadelmann & Co., Ltd.; British Driver Harris Co., Ltd.; Edison Swan Electric Co., Ltd.; Hackbridge Cable Co., Ltd.

Sheffield.—Housing Committee. Electrical installations in 398 dwellings on the Hackenthorpe estate (£5,260).—M. B. Monks.

Whitley Bay.—U.D.C. Street lighting in Earsdon Road and Seatonville Road, Whitley Bay (£1,233).—Revo Electric Co., Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aintree.—Houses (50), at Old Roan; West Lancs R.D.C. Offices, 52, Derby Road, Ormskirk.

Airdrie.—Development of estate at Burnfoot (houses, shops, church, school, community centre, etc.); burgh surveyor, Royal Buildings, Graham Street.

Alnwick.—Houses (100) at Shilbottle for miners; T. J. Cahill, architect, Lloyds Bank Chambers.

Atcham.—Houses (92), in four parishes; R.D.C. surveyor, 24, St. John's Hill, Shrewsbury.

Bedford.—Flats (54), Ashburnham Road; Max Lock, architect, 7, Victoria Square, S.W.1.

Biddulph.—Dwellings (34) at Park Lane estate for U.D.C.; W. J. Venables, architect, 1, West Road, Congleton.

Biggleswade.—Erection of Stratton School during 1953-54 (£59,170); county architect, Bedford.

Billingham-on-Tees. — Flats (42), The Causeway, for U.D.C.; J. H. Shepherd, surveyor, Council Offices, Haverton Hill-on-Tees.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

Birmingham.—Restoration works at Aston Hall (£48,713); H. J. Manzoni, city engineer.

Brentwood.—Houses (99), Ingrave; Token Construction Co., Ltd., 48, Albemarle Street, W.1.

Brierley Hill.—Dwellings (91), Swan Lane estate; J. R. Moore, architect, Moor Street.

Brighton. — Dwellings, South Woodingdean estate (76) and Craven Vale estate (62), and police offices in Market Street; borough surveyor, 26-30, King's Road.

Bristol.—Secondary school for 450 pupils at Lockleaze; city architect, Council House, College Green, Bristol, 1.

Brownhills.—Houses (48), Warrenders Arms site; Jennings, Homer & Lynch, architects, 3 and 5, Church Street, Brierley Hill.

Cheltenham.—Health centre; E. C. Boyce, county surveyor, Quay Street, Gloucester.

Chester. — Shops, maisonnettes, flats and garages, Blacon estate; city engineer, 43, Northgate Street.

Chesterfield.—Development of 23-acre site at Hady Lane for housing, and 250 houses on the Pevensey estate; R. Clegg, town clerk, Town Hall.

Chesterton.—Houses (254), in four parishes; R.D.C. surveyor, County Hall, Hobson Street, Cambridge.

Colwyn Bay.—Houses (42), Glynn estate; A. S. Powell Bowen, architect, Somerset House, Princes Drive.

Coseley.—Houses (58), eight bungalows and four shops, Batmans Hill site; J. C. Roper, clerk to U.D.C., The Council House, Coseley, near Bilston.

Cumberland.—Rural type police stations at Hallbankgate, Low Crosby and Thursby; county architect, Portland Square, Carlisle.

Doncaster.—Houses (292), Cantley and Intake estates; borough architect.

Durham. — N.C.B.'s building programme includes pithead baths at 19 collieries, baths and canteens at ten collieries and canteens at seven collieries; Architects' Dept., Ashfield Tower, Gosforth, Newcastle-on-Tyne.

Ealing.—Dwellings (130), Lime Tree estate; borough engineer.

Edinburgh.—Medical school (£1,500,000), for University authorities; W. N. Ramsey, architect, Sauchiehall Street, Glasgow.

Ellesmere Port.—Civic hall for U.D.C.; Gornall, Kelly & Partners, architects, 69, The Albany, Old Hall Street, Liverpool, 3.
Fire station (1953-54 programme); F. M. Parkes, county architect, Chester.

Gateshead.—Houses (150), Wrekenton; H. J. Cook, chief architect, Municipal Buildings.

Halifax. — Aged persons' bungalows (34); G. Holden, borough surveyor, Crossley Street.

Hayes.—Secondary grammar school on the Park House site (£150,000); Middlesex county architect.

Highgate.—Extensions to Channing School; Gollins, Melvin & Partners, architects, 15, Manchester Square, W.1.

Leeds. — Block of flats; Leeds Tenants' Housing Society, Ltd., 28, Spencer Place.

London. — FINSBURY. — Flats (48), Spencer Street; Searle & Searle, architects, Amen House, Warwick Square, E.C.4.

Manchester. — Casualty and outpatients' department at Leigh Infirmary; Bradshaw, Gass & Hope, architects, 19, Silverwell Street, Bolton.

Morpeth. — Fire station and headquarters; county architect, County Hall, Newcastle.

Newcastle-on-Tyne. — Additional storey, south block of medical school, King's College; Newcombe & Newcombe, architects, 23, Eldon Square.

Plymouth.—Houses (68), Devonport; St. Aubyn Estates, Chapel Street.

Ramsgate.—Flats (42), Park Road and East Avenue; borough engineer.

Rugby.—New casualty department for the Hospital of St. Cross; Birmingham Regional Hospital Board.

Salop. — Police divisional headquarters at Wellington (£61,500) in 1953; county architect, Shrewsbury.

Sandy.—County school (£61,000) to be built during 1953-54; county architect, Bedford.

Scunthorpe.—Erection of Priory Lane Junior School for Lindsey (Lincs) County Council; county architect, Lincoln.

Southgate.—R.C. primary school, Cannon Hill; C. E. Hanscombe, architect, 149, High Street, Epsom.

South Shields.—Old people's hostel, Lawe Road; J. Reid, borough engineer.

Stalybridge.—Houses (108) and flats, Stamford Park estate; Howard & Benson, architects, 88, Mosley Street, Manchester.

Staveley (Derbyshire).—Houses and bungalows (22), Inkersall Green estate; U.D.C. architect.

Tamworth.—Housing scheme at Hurley; A. Shaw, R.D.C. surveyor, 92, Lichfield Street.

Torquay.—Houses (96), Warberry Vale estate; P. D. Cavanna, Ltd., 300, Union Street.

West Bromwich.—New factory at Bromford Lane for Drury Casement Co., Ltd., Horton Street.

West Lancashire.—Flats and houses (88), Old Roan, Aintree; surveyor, R.D.C. Offices, Ormskirk.

Weston-super-Mare.—Extension of Bournville Junior School; R. O. Harris, architect, Park Street, Taunton.

Wigston (Leicestershire). — Houses (120) during 1953; U.D.C. architect.

Wisbech.—Factory for Metal Box Co., Ltd.; Mitchell Construction Co., Wharf Road, Peterborough.

Worcester.—Christopher Whitehead secondary modern school; director of education, 4, Copenhagen Street.

Worksop.—Central kitchen unit for Worksop and Retford Hospital; B. D. Thompson, architect, 83, Bridge Street.

Wrexham.—Community centre at Queen's Park estate; borough engineer.